Catalog of North American Early Tertiary Fossils of the Gulf and Atlantic Coastal Plain

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Edited by H. B. STENZEL

THIS catalog is prepared in a manner similar to the "Catalog of North American Devonian Fossils" published by the Wagner Free Institute of Science in Philadelphia.

The Early Tertiary catalog will contain descriptions and illustrations of the fossil invertebrates from the Paleocene, Eocene, and Oligocene of the Atlantic and Gulf Coastal Plain of the United States. Each species will be described and illustrated on a card of heavy paper 8½ by 11 inches in size, fitting a letter file. The text of the cards will be printed; the figures will be printed by full-tone collotype process. Type specimens will be figured if available; if not, photographs of topotypes will be used wherever feasible. Photographs of topotypes will be used extensively as supplementary illustrations. Original descriptions will be quoted in every case. Additional remarks or complete redescriptions will be given where necessary. Type localities and stratigraphic data have been checked in the field by specialists in nearly all cases and will be given explicitly and in an up-to-date manner. Therefore, the cards will contain much more information than is available in the literature today.

There will be running numbers for the whole catalog, one for each card. These numbers will begin with 1 and continue as long as new catalog cards are being published. Also, there will be running numbers restricted to each class. Thus the class Gastropoda will have its own numbering apart from the numbers for the entire catalog. The numbers will make it easy to arrange the cards and to refer to them in the literature.

The following cards are ready for publication:

Tetrabranchiate Cephalopoda (Nautiloidea)
28 species on 43 cards

Gastropoda—Genera Cryptochorda and Lapparia
12 species on 12 cards

Gastropoda—Family Turritellidae
81 species on 81 cards

Brachiopoda
27 species on 28 cards

The cards will be sold at the price indicated on the order blank. Two sample cards and an order blank are enclosed. Any further information will be furnished gladly.

E. H. SELLARDS, *Director*
Bureau of Economic Geology
The University of Texas
Austin, Texas

Type Data: Holotype and 8 paratypes in Bureau of Economic Geology, The University of Texas, Austin, Texas.

Type Locality: South side of Cuero Creek about 4½ miles up from San Antonio outpost, southern Maverick County, Texas. San Antonio outpost is about 0.4 mile from the Rio Grande and northeast of San Antonio crossing opposite the town of Guerrero in Mexico. (Holotype and 7 paratypes, No. 30443.)

About 1 mile north of Lopez tank on McFarland windmill road, southern Maverick County, Texas. (One paratype, No. 30448.)

Best map of this region is War Department, Corps of Engineers, U. S. Army, tactical map, Blocker's Ranch quadrangle, 1/125000, 1922.

Geologic Horizon: Upper part of Kincaid formation, Midway group, Paleocene. The fossils are found in a series of red-weathering beds of glauconitic marl which occur about 30 to 55 feet below the top of the Midway group in that region. Here, the entire group is about 200 feet thick and consists of the Kincaid formation.

Distribution: Kincaid formation in the Rio Grande region of Texas.

Synonymy:

1940 *Hercoglossa gardnerae* Stenzel, H. B., Tertiary nautiloids from the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 743–748, pl. 36, figs. 1, 2, text figs. 116(3), 117(1).

Original Description: Shell large involute, widest at the umbilical shoulder. Cross section of shell compressed oval. Umbilical shoulder fairly well defined; umbilical zone narrow, descending at an angle of 40 degrees into the umbilicus and occupying about one-fourth of the total height of the whorl. Umbilicus narrow and perforate. Lateral zones converge toward the venter at an angle of 40 degrees and are only very gently curved. Venter evenly rounded and comparatively narrow.

Septa convex apicad, widely spaced, 12 in the last preserved whorl. Siphuncle small and subventral in position. It is about three-eighths of the median height of the whorl removed from the venter. The siphuncular collar is short and oval in outline.

Sutures have a high, broad ventral saddle which is gently arched on top. The lateral lobe is deep and narrow at first but is deep and broad in the last few sutures. It is placed far over toward the venter. The lateral saddle is symmetrical, high, wide, and prominent. It is placed with its apex ventrad of the umbilical shoulder. There is a lobe at the umbilicus. The dorsal portion of the suture contains a broad lateral saddle and a deep, narrow lobe in the middle of the dorsum.

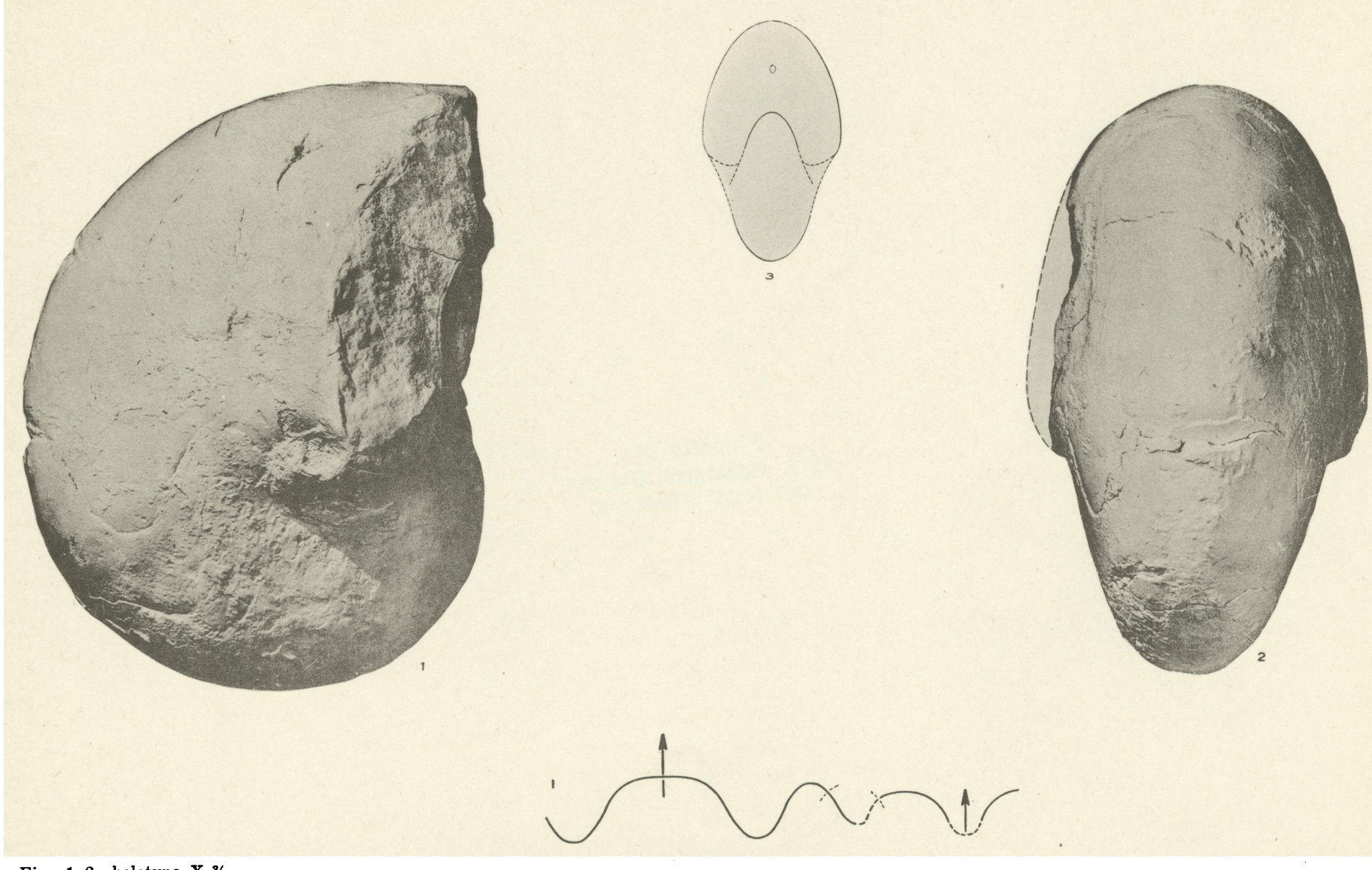
Dimensions.—Diameter of holotype 14.5 cm.

Original Remarks: This species of *Hercoglossa* is obviously related to *H. ulrichi* (White) and *H. orbiculata* (Tuomey) as figured by Miller and Thompson. In these two species the umbilical shoulder is better defined; therefore, the cross section of the whorl is more clearly triangular and less oval than in *H. gardnerae.*

The suture of *H. gardnerae* is characterized by a high, somewhat rectangular-appearing ventral saddle. In *H. orbiculata* (Tuomey) this saddle is much less rectangular in shape and broader. In other North American species of this genus the ventral saddle is not so conspicuous and not so clearly rectangular in shape but tends more to a semicircular or triangular shape. The lateral lobe of *H. gardnerae* is deeper and narrower than in *H. ulrichi* (White) and of about the same shape as in *H. orbiculata* (Tuomey). The lateral saddle of *H. gardnerae* does not differ greatly from those of *H. ulrichi* (White) and *H. orbiculata* (Tuomey).

GARDNERAE STENZEL

HERCOGLOSSA



Figs. 1, 2—holotype, X ¾,
Text fig. 116(3)—cross section of holotype, diameter 145 mm.,
Text fig. 117(1)—suture of holotype, X 0.42; Stenzel 1940.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

McGLAMERYAE MILLER & THOMPSON

Type Data: Monotype in Alabama Mus. Nat. History, University, Alabama.

Type Locality: "Lowndes County, Alabama," Miller & Thompson 1933.

Geologic Horizon: Nautilus Rock, Clayton formation, Midway group, Paleocene.

Distribution: No other specimen known.

Synonymy:

1933 *Hercoglossa mcglameryae* Miller, A. K., & Thompson, M. L., The nautiloid cephalopods of the Midway group: Jour. Paleontology, vol. 7, p. 322–324, pl. 38, figs. 1–2, text fig. 2D.

Original Description (abbreviated): Internal mold subdiscoidal, moderately large. Venter narrowly rounded; lateral zones broadly rounded; dorsum deeply impressed. Umbilicus very small. Umbilical shoulders low, but subangular and distinct. Umbilical walls flat, inclined at 135° to the lateral zones. Umbilicus about one-sixth of the diameter of the shell. Living chamber occupies at least one-third of the last whorl. Sutures have a broad, deep ventral saddle, a broad, deep, asymmetrical lateral lobe centering slightly ventrad of the umbilical shoulder. The last two septa are crowded together indicating a mature age.

Dimensions: Largest diameter at least 175 mm., diameter at right angles to this one about 125 mm.; maximum height at adoral end 110 mm., maximum width at the same place 85 mm., width of impressed zone at same place 40 mm., depth (or height) of impressed zone at same place 40 mm.

Observations: This species has greatly reduced scientific value on account of the insufficient occurrence data.

The species is more compressed laterally than *H. orbiculata* (Tuomey) and *H. ulrichi* (White). The sutures of this species are very similar to those of other species of *Hercoglossa*, but they differ from the sutures of *H. orbiculata* and *H. ulrichi* by the narrow lateral saddle, the wide and distinctly asymmetrical lateral lobe, and the highly elevated ventral saddle. These are features characteristic of the sutures of the genus *Deltoidonautilus*. Unfortunately the position of the siphuncle is unknown in this species. The position of the siphuncle would be a decisive characteristic. The shape of this species is also similar to *Deltoidonautilus*.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

McGLAMERYAE MILLER & THOMPSON

HERCOGLOSSA

Figs. 1, 2—ventral and lateral views, X ⅝,
Text fig. 2D—suture, X ¾; monotype, Miller & Thompson 1933.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

ORBICULATA (TUOMEY)

HERCOGLOSSA

Type Data: Tuomey's types lost. Neotype, Miller & Thompson, No. 612, Geology Department, State Univ. of Iowa, Iowa City, Iowa.

Type Locality: "Alabama" Tuomey 1855. Miller & Thompson have shown convincingly that Tuomey's types came probably from north of Allenton, Wilcox County, Alabama. Miller & Thompson's neotype came from Pine Barren Creek, about 5 miles north of Allenton, Wilcox County, Alabama.

Geologic Horizon: Nautilus rock of Clayton formation, Midway group, Paleocene.

Distribution: Nautilus rock of Clayton formation in Alabama.

Observations (Miller & Thompson 1933): This species is more nearly similar to *Hercoglossa ulrichi* (White) and *H. danica* (Schlotheim) than to any other described forms, but it is considerably larger than either of them, its siphuncle is much less nearly central in position, and its sutures present certain differences. In *H. ulrichi* both the lateral saddles and the lateral lobes of the sutures are distinctly shallower and more broadly rounded than are those of *H. orbiculata.* In *H. danica* the lateral lobes are distinctly narrower than the lateral saddles, whereas in *H. orbiculata* the reverse is the case. *H. tuomeyi* Clark and Martin s.s. is as large as *H. orbiculata* but its camerae are shorter and its sutures are markedly different; at least all of the external lobes and saddles of its sutures are shorter and more broadly rounded, and the septa are not crowded on the ventral flanks of the lateral lobes as they are in *H. orbiculata.*

Remarks: This species is the genotype of *Hercoglossa* Conrad 1866. Conrad's original list of species contains: *Nautilus orbiculatus* Tuomey, *Aturia matthewsoni* Gabb, and *Nautilus parkinsoni* Edwards; however, only the first of these is printed in capitals throughout and on a line by itself clearly indicating that it was meant to be the genotype. The first subsequent designation is to the same effect (Hyatt, Alpheus, Genera of fossil cephalopods: Boston Soc. Nat. History Proc., vol. 22, p. 270, 1883).

Synonymy:

1855 *Nautilus orbiculatus* Tuomey, Michael, Description of some new fossils, from the Cretaceous rocks of the southern states: Acad. Nat. Sci. Philadelphia Proc., vol. 7, p. 167–168.

1866 *Hercoglossa orbiculata,* Conrad, T. A., Observations on recent and fossil shells, with proposed new genera and species: Am. Jour. Conchology, vol. 2, p. 101.

1933 Miller, A. K., & Thompson, M. L., The nautiloid cephalopods of the Midway group: Jour. Paleontology, vol. 7, p. 315–319, pl. 37, figs. 1, 2, text fig. 2F.

Original Description: Shell somewhat discoid, thick in the centre and gradually thinner towards the circumference; last chamber very large, spreading at the umbilicus; siphunculus nearly central; septa profoundly undulating, showing on the back a sharp recurved lip.

This is the largest of the genus found in our rocks, being ten inches in diameter. It resembles quite closely *N. danicus,* especially in the undulations of the septa.

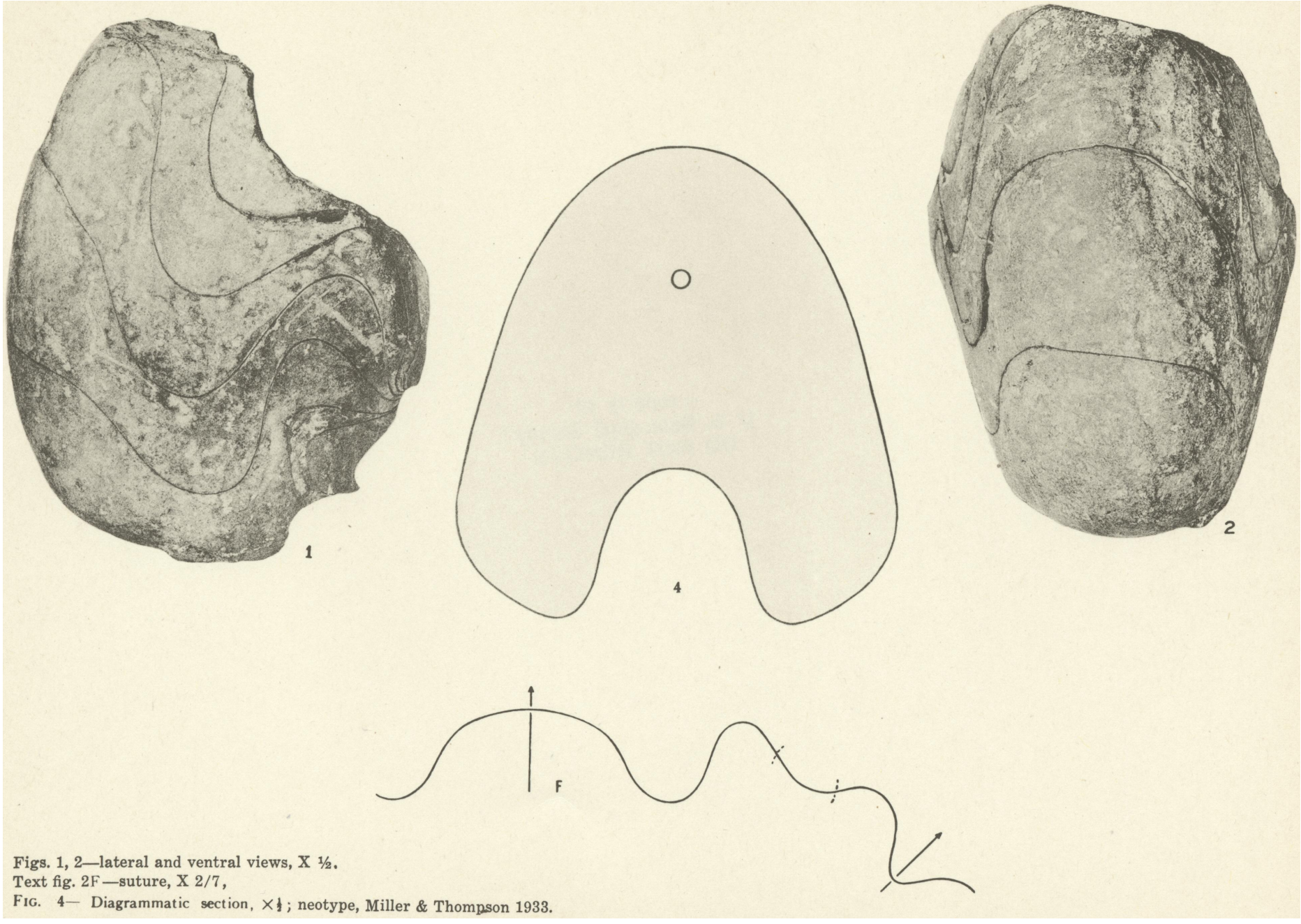
Locality, Alabama.

Revised Description based on neotype, Miller & Thompson 1933 (abbreviated): Interior mold subdiscoidal. Cross section subtrigonal; sides flattened, venter narrowly rounded, umbilical shoulders abrupt, umbilical walls fairly steep. Width almost equals height. Depth of impressed zone slightly more than one-third of height, width of impressed zone slightly less than one-half maximum width of mold. Junction of umbilical walls with impressed zone narrowly rounded. Umbilicus small and probably imperforate. Diameter of umbilicus about one-sixth of diameter of specimen.

Sutures very sinuous forming a broad, deep, very broadly rounded ventral saddle; a narrower (nevertheless very broad), narrowly rounded, asymmetrical lateral lobe; a somewhat narrower and more narrowly rounded lateral saddle located on the dorsal half of the mold; a broad rounded, asymmetrical lobe centering just outside the umbilical seam; a broadly rounded, asymmetrical saddle on the impressed zone; and a broad, rather narrowly rounded dorsal lobe.

Siphuncle small, circular in cross section, subventral in position.

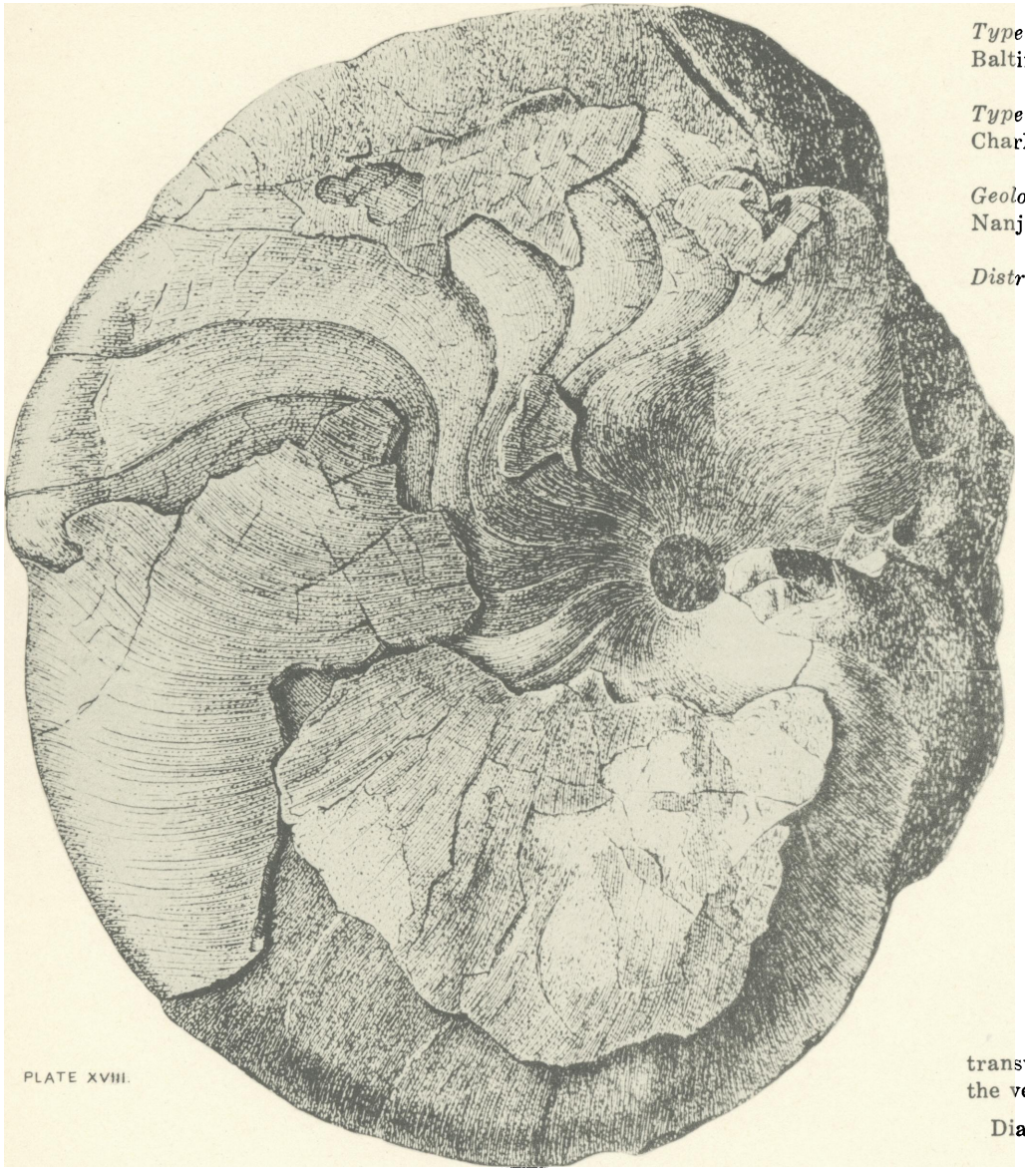
Dimensions: Maximum diameter 11 inches (estimated); at adapical end, width about 135 mm., height about 140 mm., diameter of siphuncle 8 mm.; at adoral end, width about 160 mm., height about 170 mm., impressed zone depth 65 mm., impressed zone width 75 mm.



Figs. 1, 2—lateral and ventral views, X ½.
Text fig. 2F—suture, X 2/7,
FIG. 4— Diagrammatic section, ×½; neotype, Miller & Thompson 1933.

TUOMEYI CLARK & MARTIN

HERCOGLOSSA



Type Data: Lectoholotype in Geological Department, The Johns Hopkins Univ., Baltimore, Maryland.

Type Locality: Bluff one mile below Popes Creek on left bank of Potomac River, Charles County, Maryland (compare Clark & Martin 1901, p. 71 and map).

Geologic Horizon: Upper part of Woodstock greensand marl member of Nanjemoy formation, Pamunkey group, lower Eocene.

Distribution: Known only from type locality.

Synonymy:

1901 *Hercoglossa tuomeyi* Clark, W. B., & Martin, G. C., Systematic paleontology, Eocene, Mollusca: Maryland Geol. Survey, Eocene, p. 122–123, pl. 18 [not pl. 17, pl. 19, fig. 1 = *Cimomia marylandensis* Miller & Thompson].

Original Description: Shell large; aperture wide, narrowing rapidly, without curving to a narrow and sharply rounded periphery; ventral saddles of moderate size; lateral lobes regularly but moderately rounded; lateral saddles narrower and sharper than the other saddles; umbilici not small; shell thick (2–8 mm.), marked by fine, distinct, closely-set lines of growth, which sweep sharply back on the periphery.

This species is distinguished from *H. (Enclimatoceras) ulrichi* by its much less prominent ventral saddles, and by its less uniformly rounded transverse section, the sides being almost without curvature down almost to the very periphery.

Diameter (restored) of coil of largest specimen about 400 mm.

Fig. (Pl. 18)—lectoholotype, X ⅔, Clark & Martin 1901.

ULRICHI (WHITE)

HERCOGLOSSA

Type Data: Holotype and paratypes, No. 8349, in U. S. Nat. Mus., Washington, D.C.

Type Locality: Vicinity of Olsens switch on Missouri Pacific Railroad, on Fourche Creek near the mouth of Crooked Creek, northwest quarter of southeast quarter of sec. 8, T. 1 S., R. 13 W., about 10 miles southwest of Little Rock, Pulaski County, Arkansas (Harris 1894).

Geologic Horizon: Limestone beds in basal part of Midway group, Paleocene.

Distribution: Midway group of Texas, Arkansas, Mississippi, and Alabama.

Synonymy:

1882 *Nautilus texanus*, White, C.A., On certain Cretaceous fossils from Arkansas and Colorado: U. S. Nat. Mus. Proc., vol. 4, p. 137. [Not *Nautilus texanus* Shumard.]

1883 *Enclimatoceras ulrichi*, Hyatt, Alpheus, Genera of fossil cephalopods: Boston Soc. Nat. History Proc., vol. 22, p. 270.

1884 *Enclimatoceras (Nautilus) ulrichi* White, A. C., On Mesozoic fossils: U. S. Geol. Survey Bull. 4, p. 16–17, pls. 7–9.

1886 *?Enclimatoceras hyatti?*, Aldrich, T. H., Preliminary report on the Tertiary fossils of Alabama and Mississippi: Alabama Geol. Survey Bull. 1, pt. 1, p. 60.

1894 *Enclimatoceras (Nautilus) ulrichi*, Harris, G. D., The Tertiary geology of southern Arkansas: Arkansas Geol. Survey, Ann. Rept. for 1892, vol. 2, p. 36–39, pl. 2.

1896 *Enclimatoceras ulrichi*, Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 236–239, pls. 13–15.

1933 *Hercoglossa ulrichi*, Miller, A. K., & Thompson, M. L., The nautiloid cephalopods of the Midway group: Jour. Paleontology, vol. 7, p. 319–322, text fig. 2E.

1935 Gardner, Julia, The Midway group of Texas: Univ. Texas Bull. 3301, p. 320–322.

1940 Stenzel, H. B., Tertiary nautiloids from the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 748–749, text figs. 116(4), 117(4, 5).

Original Description (White 1884): Shell moderately large; somewhat narrowly but regularly rounded upon the periphery in the adult state, and broadly rounded at the sides; whorls almost completely involute, the umbilici being very small; septa somewhat deeply concave; ventral saddles large, prominent, and regularly rounded; lateral lobes broad and moderately deep; lateral saddles prominent and narrow, and rounded at the outer end, and also becoming laterally prominent in the later formed septa of adult shells. The character of the surface is unknown, but it was apparently plain; and the test was moderately thin. In the young state the shell was more globose in form, and the septa were much less deeply lobed.

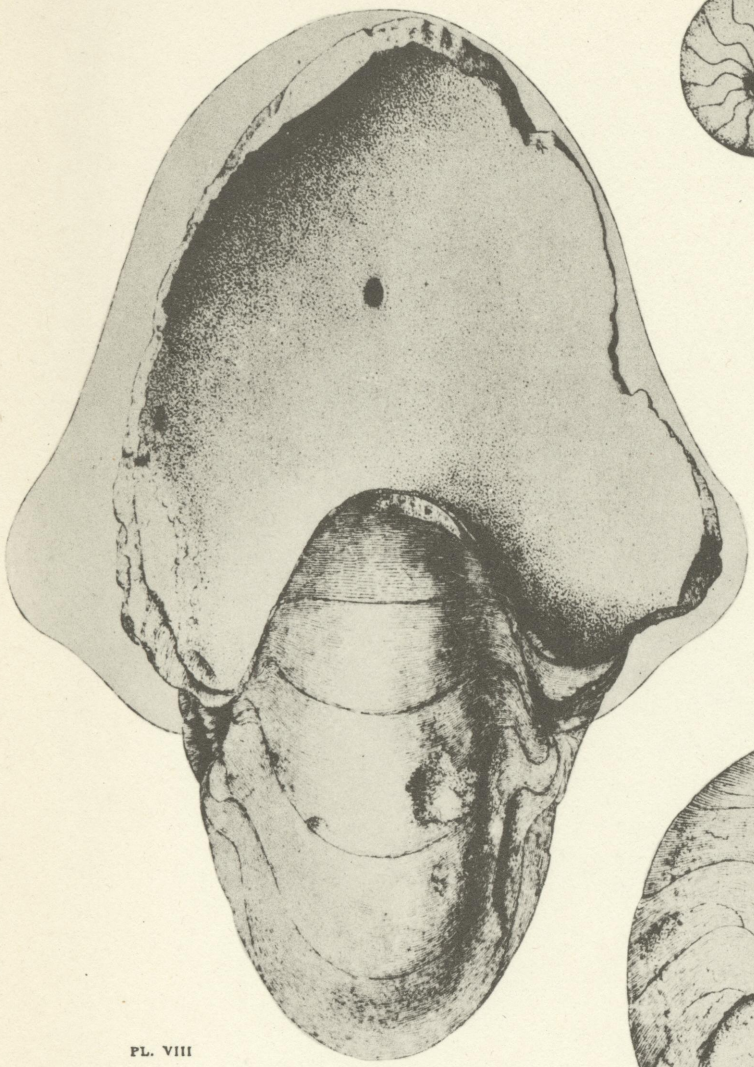
All the specimens which have yet come under my observation are in the condition of natural casts, and all are imperfect.

The diameter of the coil of the type specimen, when perfect, was apparently about 180 millimeters; the greatest transverse diameter about 125 millimeters.

Remarks: This species is the genotype of *Enclimatoceras* Hyatt 1883 by original designation.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

ULRICHI (WHITE)



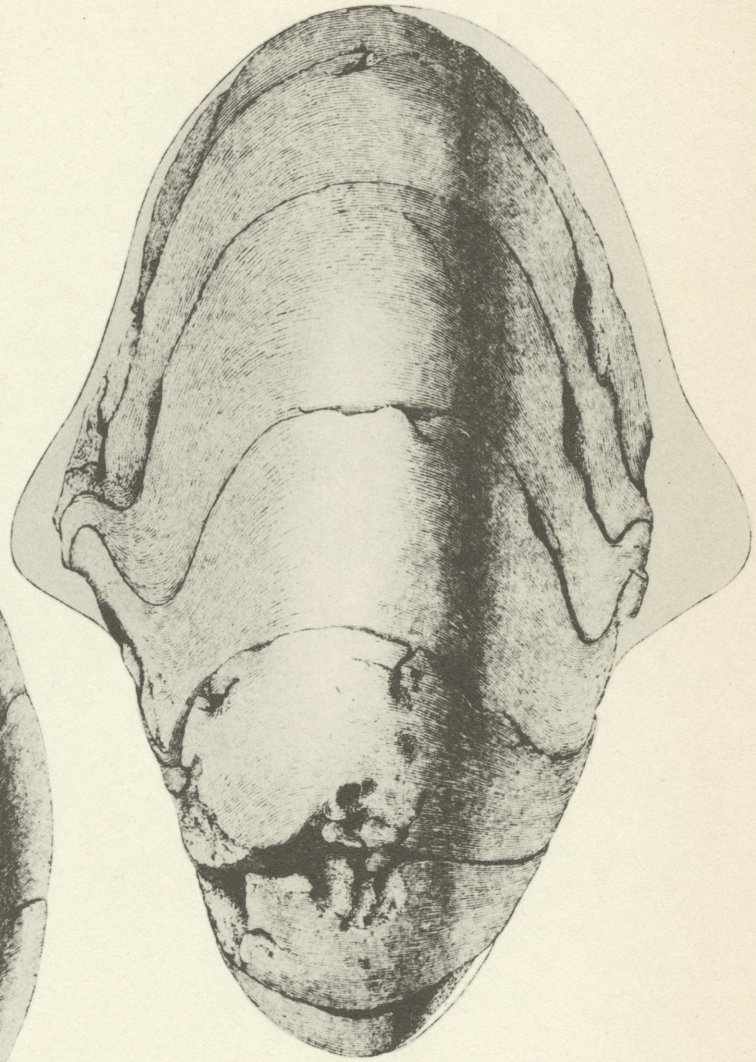
PL. VIII

2

3

1

HERCOGLOSSA



PL. IX

Figs. (Pl. 7) 1, Pl. 8, Pl. 9—holotype, X 4/5,
Figs. 2, 3—paratypes, X 4/5; White 1884.

SPLENDENS STENZEL

WOODRINGIA

Type Data: Monotype in Bureau of Economic Geology, The University of Texas, Austin, Texas.

Type Locality: South side of Foggyhead Creek in Smith's pasture and about 0.15 mile west of the bridge on Kerens-Round Prairie road, 3.8 miles by road south-southeast of the depot in Kerens, Navarro County, Texas (Bureau of Economic Geology locality No. 174–T–6).

Geologic Horizon: Uppermost beds of the Wills Point formation, Midway group, Paleocene.

Distribution: Only one specimen known.

Original Remarks: This species differs from *Woodringia simiensis* (Vokes) of the Paleocene of California by its deeper ventral lobe.

Note: This species is the genotype of *Woodringia* Stenzel 1940 by original designation.

Synonymy:

1932 *Hercoglossa ulrichi*, Plummer, H. J., Foraminiferal evidence of the Midway-Wilcox contact in Texas: Univ. Texas Bull. 3201, p. 62. [Not *Hercoglossa ulrichi* (White).]

1933 *Hercoglossa vaughani*, Plummer, F. B., Cenozoic systems in Texas, *in* The Geology of Texas: Univ. Texas Bull. 3232, p. 817, fig. 53. [Not *Cimomia vaughani* (Gardner).]

1940 *Woodringia splendens* Stenzel, H. B., Tertiary nautiloids of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 755–759, pl. 35, figs. 1–3, text figs. 120(1), 121(1, 3), 122.

Original Description: Shell inflated, involute, and medium sized. Cross section of whorls nephritic.

Umbilicus closed. Umbilical zones steep, descending at an angle of about 60 degrees into the umbilicus. Umbilical zones occupy about one-eighth of the total height of the whorl. Umbilical shoulder sharply rounded and well defined. Lateral zones gently curved, converging toward the venter at 52 degrees, and merging imperceptibly into the broadly rounded venter.

Ornamentation consisting of very faint ribs parallel with the growth lines. The growth lines (compare fig. 121(3)) retreat for a deep, but broad hyponomic sinus and arch forward at the sides. The hyponomic sinus is more sharply curved in the early part of the last preserved whorl and becomes successively broader. The lateral arch of the growth lines is not evenly curved but tends to show a higher curvature toward the umbilicus. The growth lines retreat very slightly as they cross the umbilical shoulder so that there is a very slight sinus, which may represent the ocular sinus.

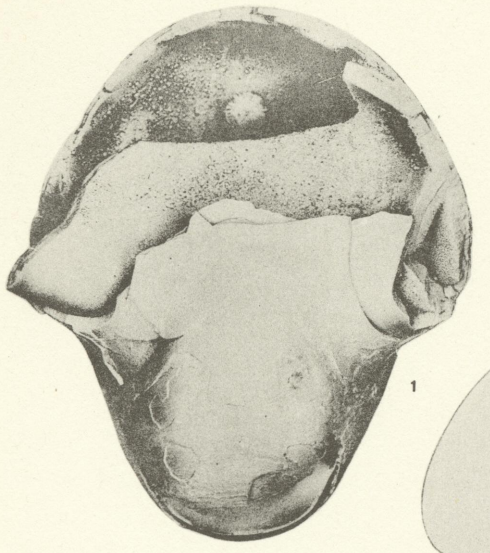
Septa convex apicad, closely spaced. It is estimated that there are about 15 in the last whorl of the specimen. Siphuncle small and subventral in position, continuous from one septum to the other (compare Pl. 35, fig. 3). The siphuncle curves down and narrows rapidly apicad from the septum at which it originates; then it swells up again to its original size and continues so in a straight line to the preceding septum.

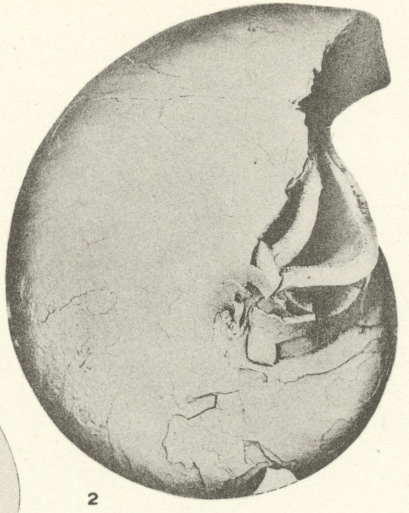
Sutures have a broad shallow ventral lobe flanked by small shallow ventral saddles, which descend steeply into the narrow round lateral lobe; a round saddle follows and terminates against the umbilical shoulder. At the umbilicus there is a broad lobe. The dorsal portion of the suture has a wide broad saddle on the impressed lateral face and a deep dorsal lobe in the center of the dorsum.

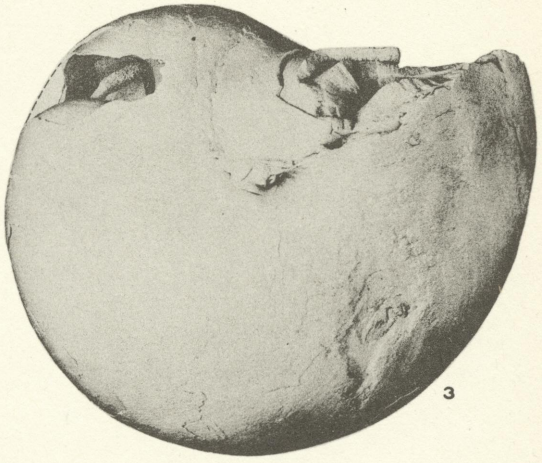
Dimensions.—Greatest diameter 7.38 cm., thickness 5.63 cm., larger radius 4.74 cm., smaller radius 2.64 cm.

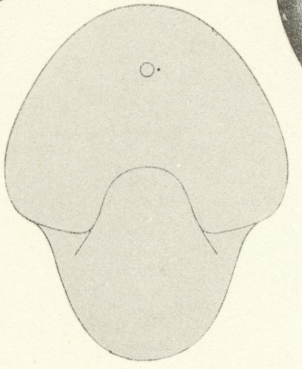
SPLENDENS STENZEL

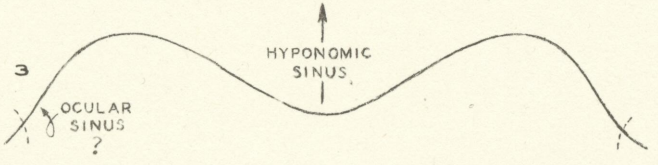
WOODRINGIA











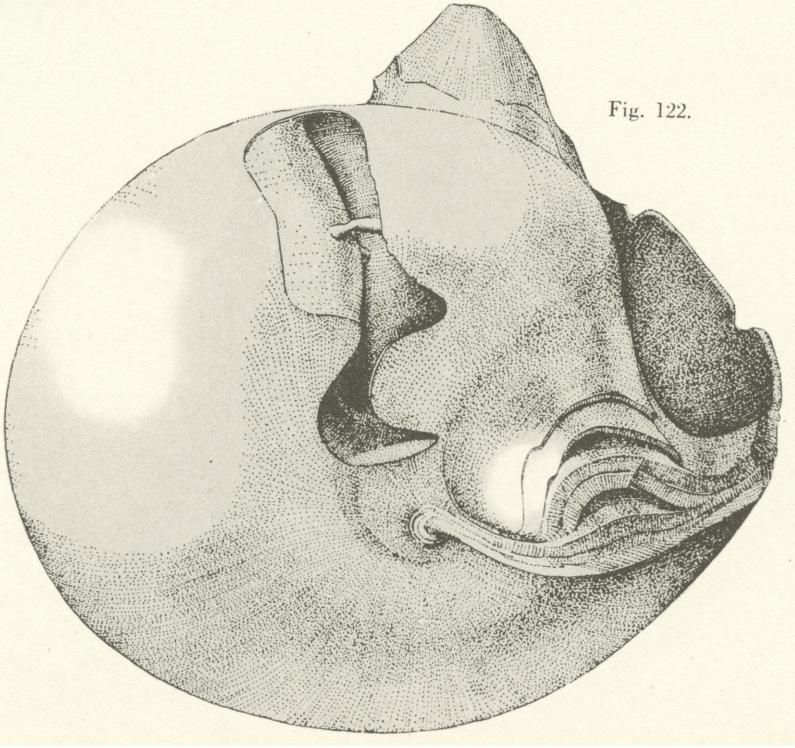


Fig. 122.

Figs. 1–3—three views, X 0.93,
Text fig. 122—oblique view, X 1,
Text fig. 120 (1)—cross section, diameter 73 mm.,
Text fig. 121 (1, 3)—suture, X 1, and growth line, X 0.85; monotype, Stenzel 1940.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

ELLIOTTI STENZEL

DELTOIDONAUTILUS

Type Data: Holotype and paratypes in Stenzel collection, Austin, Texas.

Type Locality: Bluffs along Ridge Creek about 1 mile above the Missouri, Kansas and Texas Railroad trestle and the county road bridge, 6.2 miles west of Smithville or 0.8 mile east of Upton, in east part of R. Andrews survey, Bastrop County, Texas (Bureau of Economic Geology locality No. 11–T–7). This locality is also the type locality of *Aturia turneri* Stenzel.

Geologic Horizon: Marquez shale member, Reklaw formation, Claiborne group, middle Eocene. These nautiloids occur approximately at the level of a concretionary, discontinuous, fossiliferous, lenticular, impure limestone, which is about 44 feet below the top of the Marquez shale.

Distribution: Known only from type locality.

Original Remarks (abbreviated): Deltoidonautilus elliotti differs from the type of the genus, *D. sowerbyi* (Wetherell), by the shorter distance of the lateral saddle from the umbilical shoulder and by the more curved lateral zones in adult *D. elliotti*, which consequently does not appear as clearly triangular in cross section as *D. sowerbyi.*

Deltoidonautilus elliotti falls among the species transitional from *Hercoglossa* to typical triangulate *Deltoidonautilus*, but it nevertheless is a true *Deltoidonautilus* rather than an "advanced" *Hercoglossa*. It differs from *Hercoglossa* by the prominent ventral saddle of its suture, the nearly triangular cross section of its whorls, and the subdorsal position of the siphuncle.

Synonymy:

1940 *Deltoidonautilus elliotti* Stenzel, H. B., Tertiary nautiloids from the Gulf Coastal Plain: Univ. Tex. Pub. 3945, p. 759–764, pl. 38, figs. 1–6, pl. 39, figs. 1, 2, text figs. 123(2), 124(2).

Original Description: Shell large, the largest specimen attaining a diameter of about 17 cm. Shell thick lenticular in shape and involute. Cross section of earlier whorls is truncate-triangular with a nearly flat and truncate venter and nearly straight and short lateral zones (compare Pl. 38, fig. 5). The cross section of the later whorls gradually becomes high-triangular in outline with gently curved and converging sides and sharply rounded venter; the whorls are widest at the umbilical shoulder.

Umbilical shoulder well defined; umbilical zone narrow, descending nearly vertically into the umbilicus and occupying only about one-fifteenth of the total height of the later whorls. Umbilicus narrow and perforate, filled with matrix in all figured specimens. Lateral zones converge toward the venter at an angle of 48 degrees and are gently curved to flat and very long, extending from the umbilical shoulder very nearly to the venter. Venter narrowly but evenly rounded.

Ornamentation absent, except for growth lines and very indistinct spiral lines. The growth lines are highly arched forward at the sides and retreat deeply for the sharply curved hyponomic sinus. The spiral lines are present only on paratype 2 and in this specimen only where the original shell surface is preserved. The lines are very fine obsolete wavy raised spirals best developed on the lateral zone near the umbilicus.

Septa convex apicad, closely spaced, presumably about 25 in the last air-chamber whorl of the holotype. Siphuncle extracentrodorsan in position, that is, slightly less than one-quarter of the median height of the whorl removed from the dorsum. The invagination of the septa which forms the siphuncular collar is small in diameter and restricted to the immediate vicinity of the siphuncle. Siphuncular collar tubular and long, extending certainly from one septum to the preceding one, presumably even to the next.

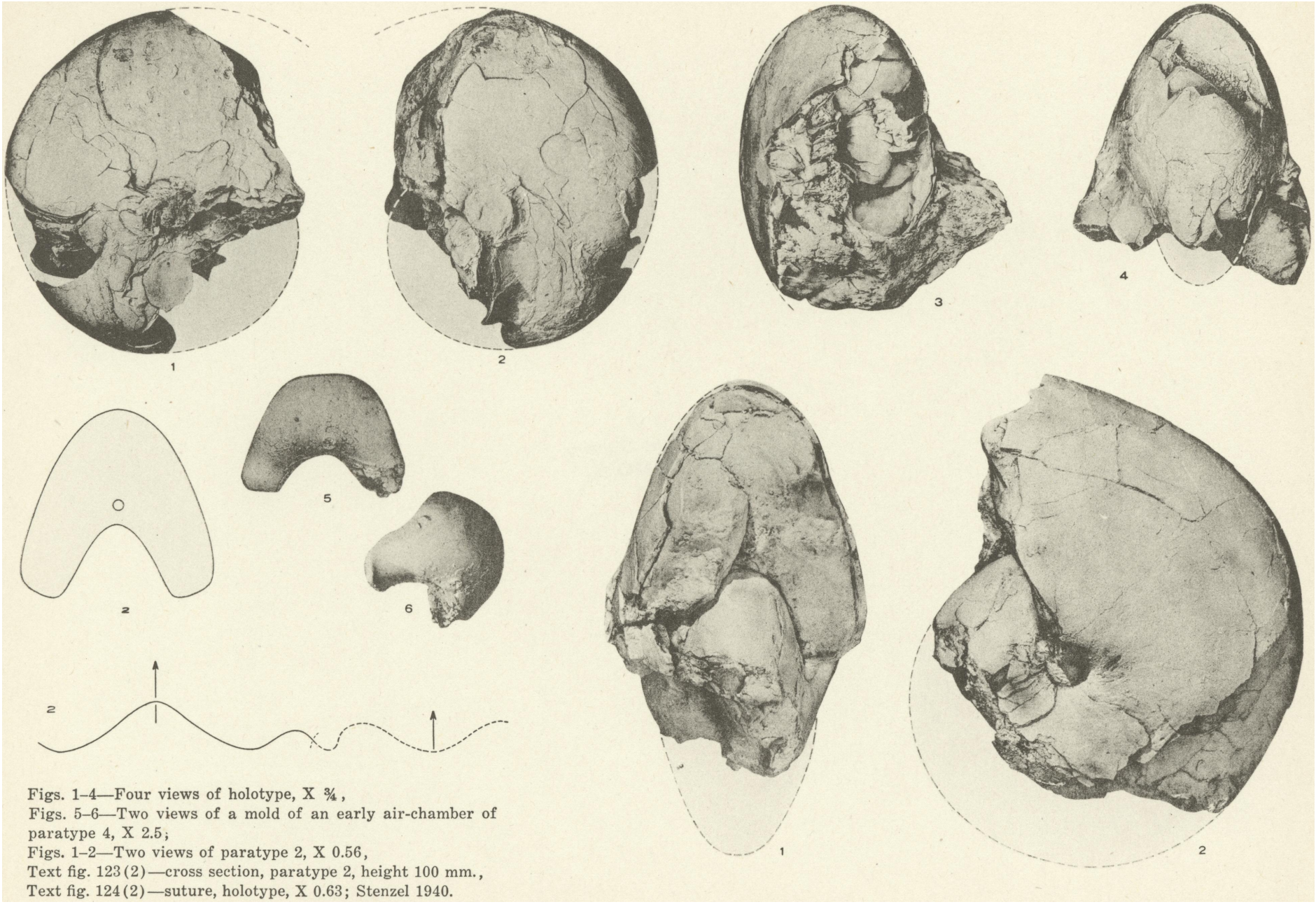
Sutures have a prominent, rounded-triangular ventral saddle, which is higher than any other saddle or lobe. The lateral lobe is broad and gently curved; the lateral saddle is relatively deep and narrow and lies a short distance ventrad from the umbilical shoulder; a medium-sized lobe lies on the umbilicus; a broad and shallow saddle lies on the lateral side of the impressed region opposite to the lateral saddle of the outside of the shell; at the dorsum there is a broad lobe.

Dimensions: Holotype, diameter 8.4 cm.; greatest width 4.8 cm.; median height 3.2 cm. and 2.1 cm., taken on opposite sides of the above measured diameter. Paratype 2, height of whorl of living chamber 9.7 cm.; greatest width in same cross section 8.7 cm.; diameter of umbilicus 1.2 cm. Paratype 3, height of whorl of living chamber 9.2 cm.; greatest width at same cross section 7.3 cm. + (measurement slightly too small on account of pressure deformation of specimen). Paratype 4, median height of one of the early air chambers 0.66 cm.; greatest width 1.14 cm.; total height 0.9 cm.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

ELLIOTTI STENZEL

DELTOIDONAUTILUS



Figs. 1–4—Four views of holotype, X ¾,
Figs. 5–6—Two views of a mold of an early air-chamber of paratype 4, X 2.5;
Figs. 1–2—Two views of paratype 2, X 0.56,
Text fig. 123(2)—cross section, paratype 2, height 100 mm.,
Text fig. 124(2)—suture, holotype, X 0.63; Stenzel 1940.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

PAUCIFEX (COPE)

Type Data: Holotype, No. 13133, Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania.

Type Locality: Marl pit of Mr. Thos. Heritage at Hurffville, north of Glassboro, Gloucester County, New Jersey.

Geologic Horizon: Hornerstown marl, Rancocas group, lower Eocene. For section exposed at type locality see Cook 1868, p. 272; compare also "The identity of the matrix with that surrounding specimens of Teredo tibialis, and Terebratula fragilis and Harlani, taken from that bed by Prof. C., seemed conclusive on this point." Cope 1866.

Distribution: Known only from type locality.

Original Remarks: This species most resembles Nautilus Parkinsoni, which cannot be far removed from Aturia. In it the septary process approaches closely the succeeding septum; while in the A. pancifex they fall far short of the latter, and are more divaricate; the siphuncle is less dorsally situate, measuring one-fourth the diameter in the former. In A. Agustata, Conrad, from the Eocene of Oregon, there is much resemblance, but that animal is much more like the *zic-zac;* its septary processes are not divaricate and but little separated; the dorsal portion of the septary wall instead of being opposite its ventral portions is opposite that of the septum next anterior. The nearest ally is the A. Mathewsonii Gabb. It appears to differ in the small siphuncle, and obliquely truncate and divaricate septary processes, and the relatively much shorter median or central portion of the septary margins.

It has some resemblance to the *zic-zac,* but presents fewer and more distant septa, longer chambers, and the parietal processes of the septa more divaricate and less dorsally situate. It differs from the A. Alabamensis (Morton) by the same features, and in the smaller siphuncle and much less parallel septa.

Revised Description: Shell involute, sublenticular in shape. Cross section of whorl triangular to oval, widest very near the distinct but broadly rounded umbilical shoulder. Umbilical zone wide and moderately steep, occupying about one-fourth of the total height of the whorl. Lateral zones flat, short, converging at an angle of 38 degrees; venter broadly rounded. Umbilicus occupies about one-seventh of the diameter of the shell.

Septa only 9 in last whorl, convex apicad, invaginated at the lateral lobes. Siphuncle moderate in size, circular in cross section, subdorsal in position. Suture with a very broad, rounded ventral saddle, an asymmetrical, curved lateral lobe ending in a narrowly rounded tip, a broad, rounded lateral saddle, a narrow umbilical saddle.

Surface of holotype, an internal mold, marked by numerous small longitudinal ridges or raised lines, discontinuous because interrupted by the broad sutures. For detailed description see Miller & Thompson 1935.

Synonymy:

1866 *Aturia pancifex* Cope, E. D., Remarks on a species of Aturia found in the marl pits at Glassboro, N.J.: Acad. Nat. Sci. Philadelphia, Proc. for 1866, p. 3–4.

1867 *Aturia paucifex,* Cope, E. D., On Euclastes, a genus of extinct Cheloniidae: Acad. Nat. Sci. Philadelphia, Proc. for 1867, p. 39–40.

1868 *Hercoglossa paucifex,* Conrad, T. A., *in* Cook, G. H., Geology of New Jersey, p. 731.

1892 Whitfield, R. P., Gasteropoda and Cephalopoda of the Raritan clays and greensand marls of New Jersey: U. S. Geol. Survey Mon. 18, p. 246–248, pl. 39, fig. 1.

1907 Weller, Stuart, A report on the Cretaceous paleontology of New Jersey: New Jersey Geol. Survey, Paleont. ser., vol. 4, p. 815–816, pl. 102, fig. 1.

1927 *Paraturia paucifer,* Spath, L. F., Revision of the Jurassic cephalopod fauna of Kachh (Cutch): India Geol. Survey, Palaeontologia Indica, new ser., vol. 9, mem. 2, pt. 1, p. 26.

1928 *Aturoidea paucifex,* Vredenburg, E. W., & Cotter, G. de P., A supplement to the molluska of the Ranikot series: India Geol. Survey, Palaeontologia Indica, new ser., vol. 10, mem. 4, p. 13–20 and correction slip.

1928 *"Hercoglossa" paucifex,* Cooke, C. W., & Stephenson, L. W., The Eocene age of the supposed late Upper Cretaceous greensand marls of New Jersey: Jour. Geol., vol. 36, p. 143, 144.

1935 *Aturoidea paucifex,* Miller, A. K., & Thompson, M. L., The nautiloid genus Aturoidea in America: Jour. Paleontology, vol. 9, p. 566–568, pl. 65, figs. 1, 2, text fig. 1.

Original Description: Uncovered chambers nine; septary process elongate, acuminate, shallow, diverging outward from a spiral line joining their bases; well separated from the succeeding septa; dorsal portions of the septa short, very excentric as regards each other; ventral portions opposite them, forming nearly a right angle with the ventral outline. Siphuncle small, more dorsal than the end of the dorsal fourth of the diameter. Ventral face broad rounded; septal processes scarcely visible on the ventral view. Diameter of the last chamber 3 in. 11 l.; of first visible (at siphuncle) 22 l. Median diameter (from penultimate chamber) 8 inches.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

PAUCIFEX (COPE)

ATUROIDEA

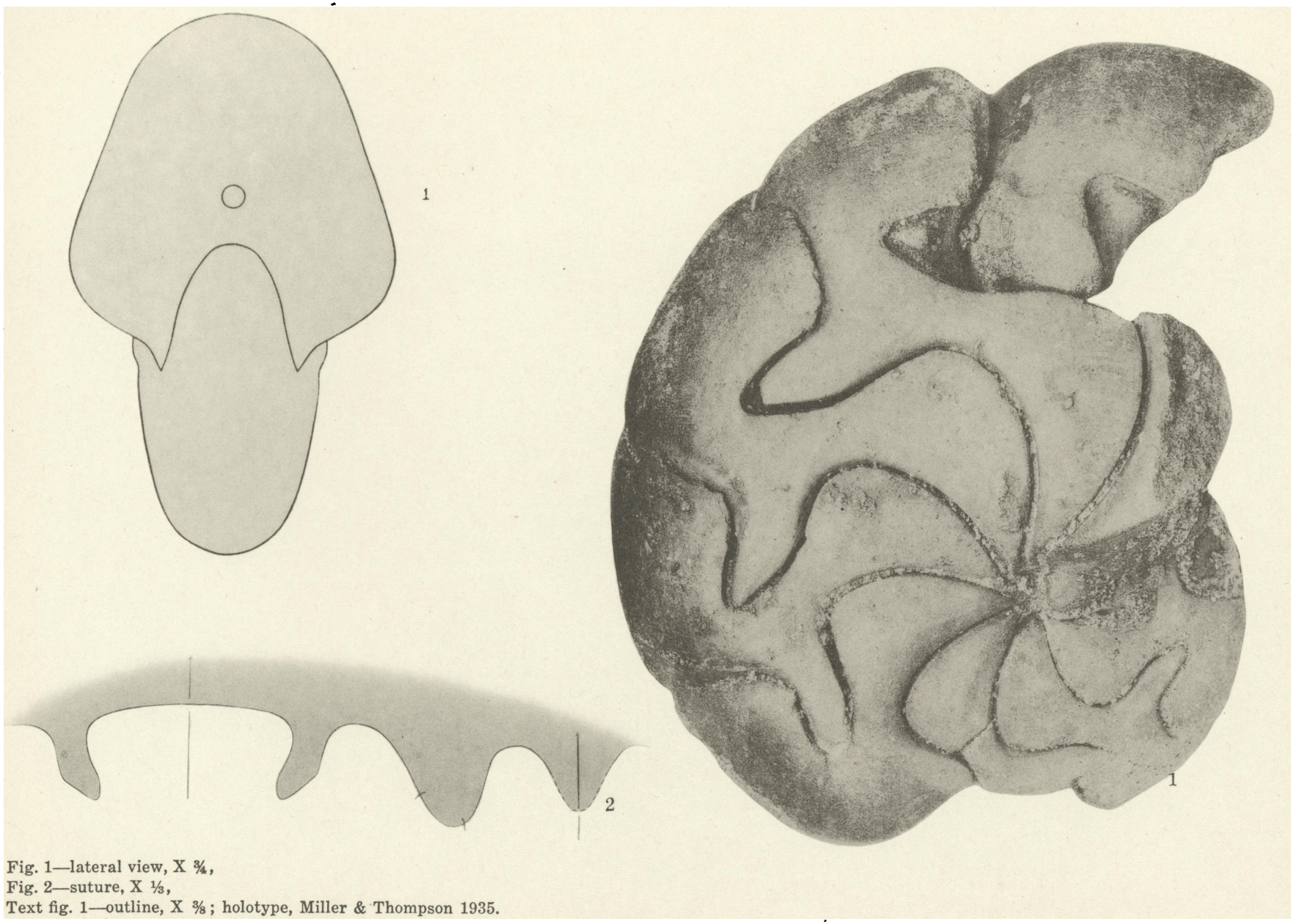
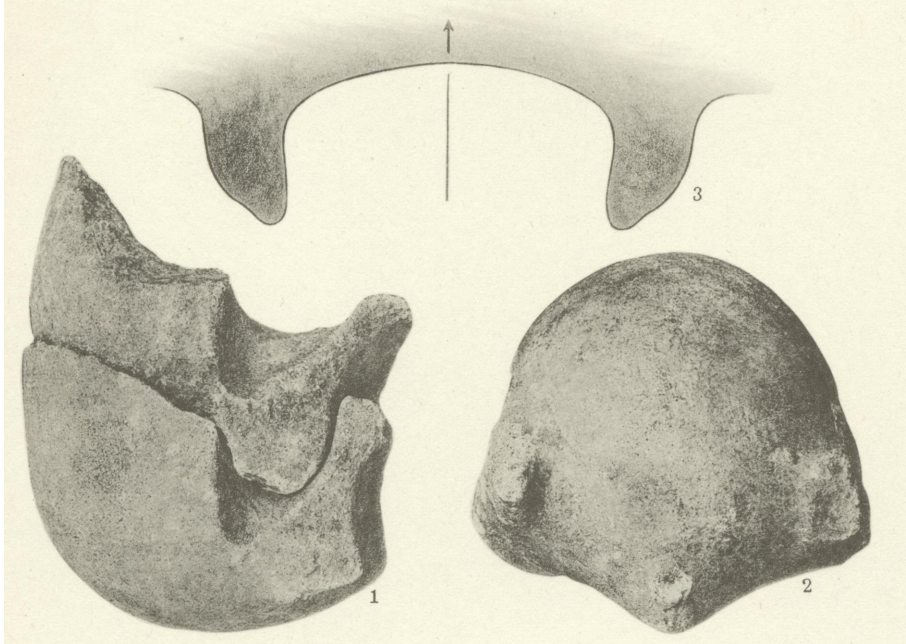
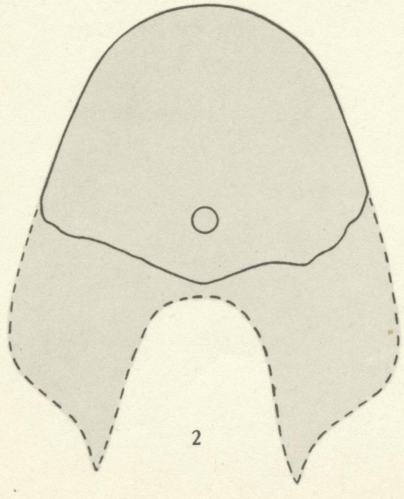


Fig. 1—lateral view, X ¾,
Fig. 2—suture, X ⅓,
Text fig. 1—outline, X ⅜; holotype, Miller & Thompson 1935.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.





Figs. 1–2—lateral and septal (apical) views, X ¾,
Fig. 3—suture, X ½,
Text fig. 2–cross section, X ½; monotype, Miller & Thompson 1935.

Type Data: Monotype, No. 13137, Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania.

Type Locality: "At or near Medford, New Jersey" (original label, Miller & Thompson 1935). Medford is in Burlington County.

Synonymy:

1935 *Aturoidea pilsbryi* Miller, A. K., & Thompson, M. L., The nautiloid genus Aturoidea in America: Jour. Paleontology, vol. 9, p. 568–569, pl. 66, figs. 1–3, text fig. 2.

Original Description: Holotype, ventral portions of two camerae of a conch comparable in size and shape to that of *A. paucifex*. Curvature of venter indicates that phagmacone attained maximum diameter (measured across umbilicus) of at least 200 mm. Conch flattened laterally, rounded ventrally, impressed dorsally; cross section similar to that of *A. paucifex;* maximum width 80 mm.; at adoral end distance from venter to dorsum (bottom of impressed zone) slightly more than 70 mm.

Surface of internal mold devoid of markings other than sutures. Septa only slightly curved laterally, strongly curved dorso-ventrally; ventral portion convex apicad, dorsal portion presumably concave apicad. Length of adapical camera, measured along venter, about 40 mm. Preserved part of each suture forms large, broad, deep, broadly rounded ventral saddle; on either side of it a much narrower, narrowly rounded, long lateral lobe (dorsal side of which is sigmoidal), and a deep lateral saddle.

Siphuncle moderate in size, circular in cross section, subdorsal in position, orthochoanitic in structure; at adoral end siphuncle 7 mm. in diameter; its center 52 mm. from venter, slightly more than 15 mm. from dorsum (bottom of impressed zone).

Original Remarks: A. pilsbryi resembles rather closely *A. paucifex* (Cope), *A. parkinsoni* (Edwards), and *A. spathi* Vredenburg, but it is not very close to the other known representatives of this genus, except possibly *A. mathewsonii* (Gabb). The relatively short and broad lateral lobes of its sutures distinguish this species from *A. paucifex, A. parkinsoni,* and *A. spathi.* Also, the siphuncle of *A. paucifex* is distinctly larger than is that of *A. pilsbryi.*

Geologic Horizon: Unknown. The specimen is composed of hard cream-colored limestone containing numerous scattered grains of glauconite and weathering to a light brown color. This composition seems to indicate that it came from the Vincentown formation, Rancocas group, lower Eocene. This formation crops out along the creek just west of Medford.

Distribution: Only one specimen known.

ALABAMENSIS (MORTON)

ATURIA

Type Data: Topotype (Schenck 1931 and Aldrich 1931) in Alabama Mus. Nat. History, University, Alabama.

Type Locality: Near Claiborne, Alabama (Morton 1834). Presumably in the vicinity of Suggsville, Clarke County, Alabama.

Geologic Horizon: Ocala limestone, Jackson group, upper Eocene.

Distribution: Reported from the Castle Hayne marl of North Carolina (Kellum 1926), from the Ocala limestone of Florida (Stenzel 1935 and Cooke, C. W., The age of the Ocala limestone: U. S. Geol. Survey Prof. Paper 95, p. 111, 1915), from the Ocala limestone in Alabama (Stenzel 1935, Schenck 1931), from the "Zeuglodon bed" in Alabama (Cooke 1915), from the Moodys marl in Mississippi (Stenzel 1935), and from the Jackson group of Mexico (Stenzel 1935 and Miller, A. K., & Furnish, W. M., Aturias from the Tertiary of Mexico: Jour. Paleontology, vol. 12, p. 153–154, pl. 25, figs. 1, 2, 5, 6, 1938), all in the Jackson group, upper Eocene.

Observations: Most specimens found in the type region are internal molds of white chalky limestone in many cases pressure-deformed.

This species is of narrower cross section than the other Eocene Aturias of North America.

Synonymy (partial):

1834 *Nautilus alabamensis* Morton, S. G., Synopsis of the organic remains of the Cretaceous group of the United States, Philadelphia, p. 33, pl. 18, fig. 3.

1887 *Aturia ziczac* [part], Geinitz, H. B., Ueber Nautilus Alabamensis Morton, Nautilus ziczac Sow. und Nautilus lingulatus v. Buch: Neues Jahrb., vol. 2, p. 53–56, pl. 3.

1890 *Aturia ziczac* + *Nautilus? alabamensis*, De Gregorio, A., Monographie de la faune éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Ann. Géol. Paléont., livr. 7–8, p. 14–15, pl. 1, figs. 37, 38a, 38b.

1893 *Nautilus alabamiensis*, Cossmann, M., Notes complémentaires sur la faune éocénique de l'Alabama: Ann. Géol. Paléont., livr. 12, p. 51.

1926 *Aturia alabamensis*, Kellum, L. B., Paleontology and stratigraphy of the Castle Hayne and Trent marls in North Carolina: U. S. Geol. Survey Prof. Paper 143, p. 7, 8, 11, 32.

1931 Schenck, H. G., Cephalopods of the genus Aturia from western North America: Univ. California Dept. Geol. Sci., Bull., vol. 19, no. 19, pls. 77–78.

1931 Aldrich, T. H., Description of a few Alabama Eocene species and remarks on varieties: Alabama Geol. Survey, Mus. Paper 12, p. 7, pl. 4, fig. 1.

1935 Stenzel, H. B., Nautiloids of the genus Aturia from the Eocene of Texas and Alabama: Jour. Paleontology, vol. 9, p. 556–557, pl. 63, figs. 2a–2b; text fig. 5.

Original Description: Shell suboval, compressed; septae profoundly sinuous; siphuncle very large. Length 10 inches; height 9 inches; greatest diameter 4½ inches.

From the newer cretaceous rock, near Claiborne, Alabama.

Revised Description (based on topotypes): Shell involute, compressed. Growth lines arched forward at the sides, curved back at the venter for a deep and sharply curved hyponomic sinus. Cross section high and narrow, widest at umbilical shoulder, which is indistinct. Umbilical zone narrow, occupying about one-seventh of the total height of the whorl; lateral zones nearly flat, converging at an angle of about 27 degrees; venter regularly and broadly rounded. Umbilicus closed.

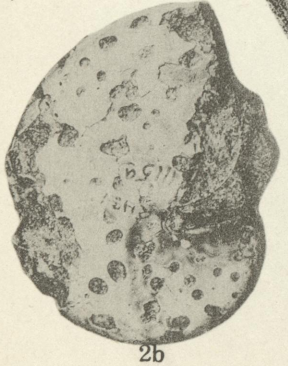
Septa convex apicad, invaginated for the lateral lobes and around the siphuncle. Septa about 13 in the adult whorl. Sutures slightly arched forward at the venter ending in a small saddle at the corner leading to the tongue-shaped lateral lobes; lateral lobes slender, long, pinched-in and hooked-in at the point; lateral saddle broadly arched. Successive sutures touch where the point of the lateral lobes approaches the ventral basal corner of the preceding lobe. Siphonal invaginations medium large.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

ALABAMENSIS (MORTON)

ATURIA

2a

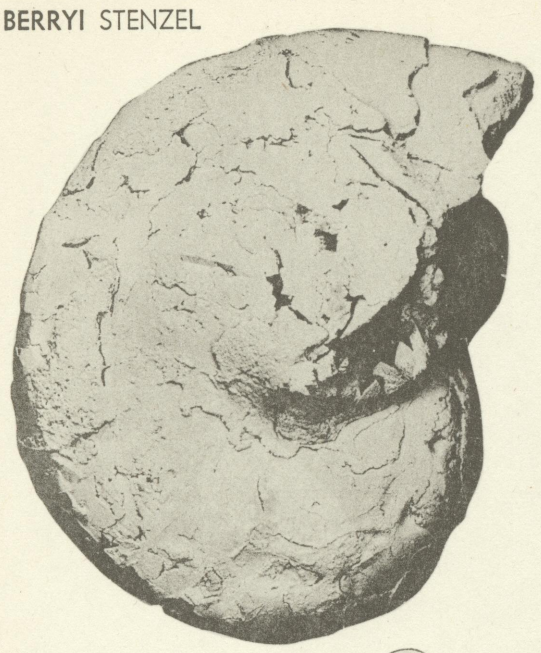


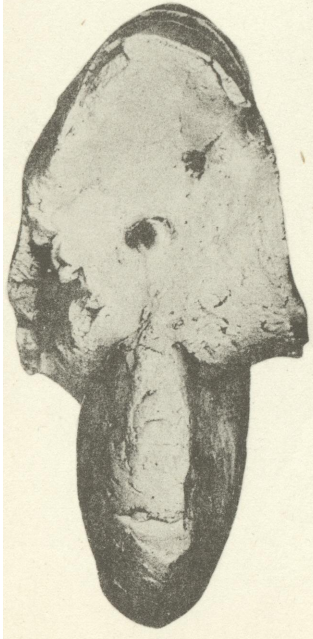
2b

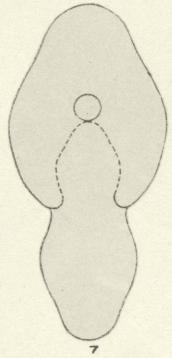
Fig. 3—Morton 1834.
Fig. 1—topotype, diameter 19 cm., Aldrich 1931.
Figs. 2a, 2b—specimen from Moodys marl of Moodys branch in Jackson, Hinds County, Mississippi, X 1, Stenzel 1935.

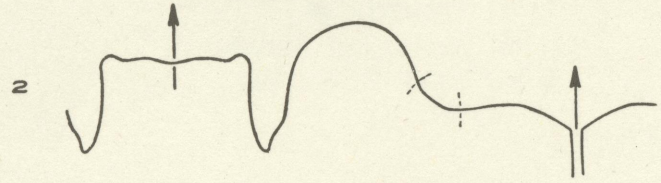
BERRYI STENZEL

ATURIA









Figs. 1–3—Three views, X 3, Text fig. 125(7)—cross section, diameter 40 mm., Text fig. 126(2)—suture, X 2.22; all monotype, Stenzel 1940.

Type Data: Monotype in Aldrich collection, Geological Department, The Johns Hopkins Univ., Baltimore, Maryland.

Type Locality: Vicksburg, Warren County, Mississippi.

Geologic Horizon: Vicksburg group, Oligocene. The particular horizon within the Vicksburg group from which the specimen was collected by T. H. Aldrich is not known. Small pieces of matrix adhering to the shell consist of speckled, yellow-gray, glauconitic limestone or indurated marl.

Synonymy:

1886 *Nautilus—sp.?* Aldrich, T. H., Notes on the distribution of Tertiary fossils in Alabama and Mississippi: Cincinnati Soc. Nat. History Jour., vol. 8, p. 257.

1940 *Aturia (Aturia) berryi* Stenzel, H. B., Tertiary nautiloids from the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 764–770, text figs. 125(7), 126(2), pl. 40, figs. 1–3.

Original Description: Shell involute, compressed, discoidal. Cross section of whorl high and narrow, widest near the middle of the lateral zones. Umbilical shoulder very indistinct or absent; umbilical zones merging imperceptibly into the lateral zones and occupying approximately one-fifth or one-sixth of the total height of the whorl. Umbilicus closed, forming merely a shallow dell. Lateral zones gently arched, converging at an angle of 25 degrees; venter narrow and rounded.

Septa convex apicad, broadly invaginated at the lateral lobes and the siphuncle. Septa 12 in the last preserved whorl. Sutures slightly wavy across the venter so that there is a very shallow ventral lobe in the center flanked on either side by a very shallow ventral saddle; a small and narrow, but prominent saddle at the ventral corner of the base of the lateral lobe; lateral lobes slender, tapering abruptly to a pinched-in and only very slightly recurved end; lateral saddle highly arched with the sharpest curvature at the turning point to the lateral lobe. Successive sutures touch with the point of the lateral lobe onto the preceding saddle at the base of the lateral lobe.

Dimensions.—Greatest preserved diameter 2.8 cm.; greatest thickness 1.15 cm.; larger radius 1.74 cm.; smaller radius 1.06 cm.; whorl increase ratio 2.69; ratio thickness over diameter 0.411.

Original Remarks (abbreviated): This is one of the more compressed forms of the genus and has very shallow umbilici; it is in these respects a very advanced form. The suture of this species has a very shallow yet distinct lobe at the venter. A further characteristic of *Aturia berryi* is the position of the thickest place in the shell. Aturias are usually thickest at or near the umbilical shoulder. However, *Aturia berryi* has its greatest thickness about halfway between venter and umbilicus.

Distribution: Only one specimen known.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

Type Data: Primary types in Stenzel collection, Austin, Texas. A metatype in British Mus. Nat. History, London, England.

Type Locality: Stone City (Moseleys Ferry), bluff on right bank of Brazos River at bridge of State Highway 21 and bridge of Southern Pacific Railroad, Burleson County, Texas.

Geologic Horizon: Stone City beds, Claiborne group, middle Eocene.

Distribution: Tyus and Viesca members of Weches formation in central and east Texas and Stone City beds of the type locality, all in Claiborne group, middle Eocene. Possibly also in Cook Mountain formation of Rio Grande region in south Texas, Claiborne group, middle Eocene (compare Stenzel 1940).

Synonymy:

1935 *Aturia (Brazaturia) brazoensis* Stenzel, H. B., Nautiloids of the genus Aturia from the Eocene of Texas and Alabama: Jour. Paleontology, vol. 9, p. 559–561, pl. 64, figs. 1a–1f, text fig. 3.

1940 Stenzel, H. B., Tertiary nautiloids from the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 774–779, text figs. 125(5), 126(4).

Revised Description (based on types): Shell involute. Growth lines arched forward at the sides, curved back at the venter for a deep and sharply curved hyponomic sinus. Cross section of whorl compressed oval, widest at the umbilical shoulder in young specimens, widest at a place 3/10 of the height of the whorl removed from the umbilicus in mature specimens; umbilical shoulder indistinct; umbilical zone occupies about 1/8 to 1/9 of the height of the whorl; lateral zones short and nearly flat converging at an angle of 36° to 44°; venter rounded, its broadness increasing with age. Umbilicus deep and steep walled.

Septa convex apicad, invaginated for the lateral lobes and around the siphuncle. Septa about 17 in the adult whorl. Sutures slightly arched forward at the venter ending in a small saddle at the corner leading to the tongue-shaped lateral lobes; lateral lobes slender, long, pinched-in and hooked-in at the point; lateral saddle broadly arched. Successive sutures touch where the point of the lateral lobe approaches the ventral basal corner of the preceding lobe. Siphonal invaginations large.

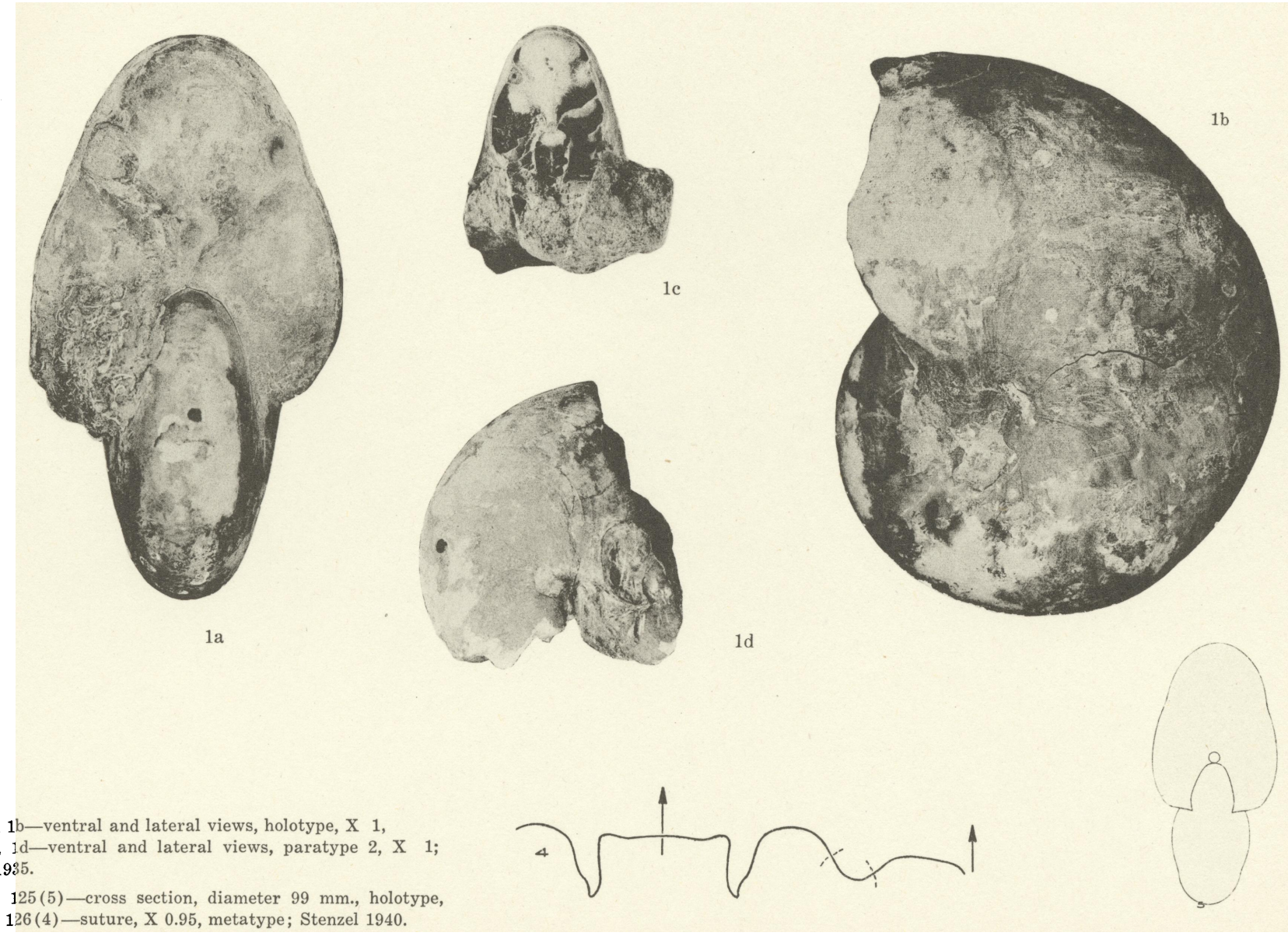
Dimensions: Holotype, diameter, 102 mm., height of last preserved whorl, 62 mm.; median height, 42 mm.; greatest thickness, 51 mm. Paratype 2, height of last preserved whorl, 33 mm.; greatest thickness, 28 mm.; height of whorl at last septum, 23 mm.; median height, 14 mm.; greatest thickness, 21 mm. Paratype 3, diameter, about 240 mm.; height of last preserved whorl, 136 mm.; median height, 91 mm.; greatest thickness, 22 mm.

Original Remarks: This species is easily distinguished from *A. alabamensis* and *A. triangula* by its fairly broad, inflated cross section; from *A. laticlavia* by its less highly arched lateral saddle and other features of the suture.

Note: This species is the genotype of the subgenus *Brazaturia* Stenzel 1935 by original designation.

BRAZOENSIS STENZEL

ATURIA

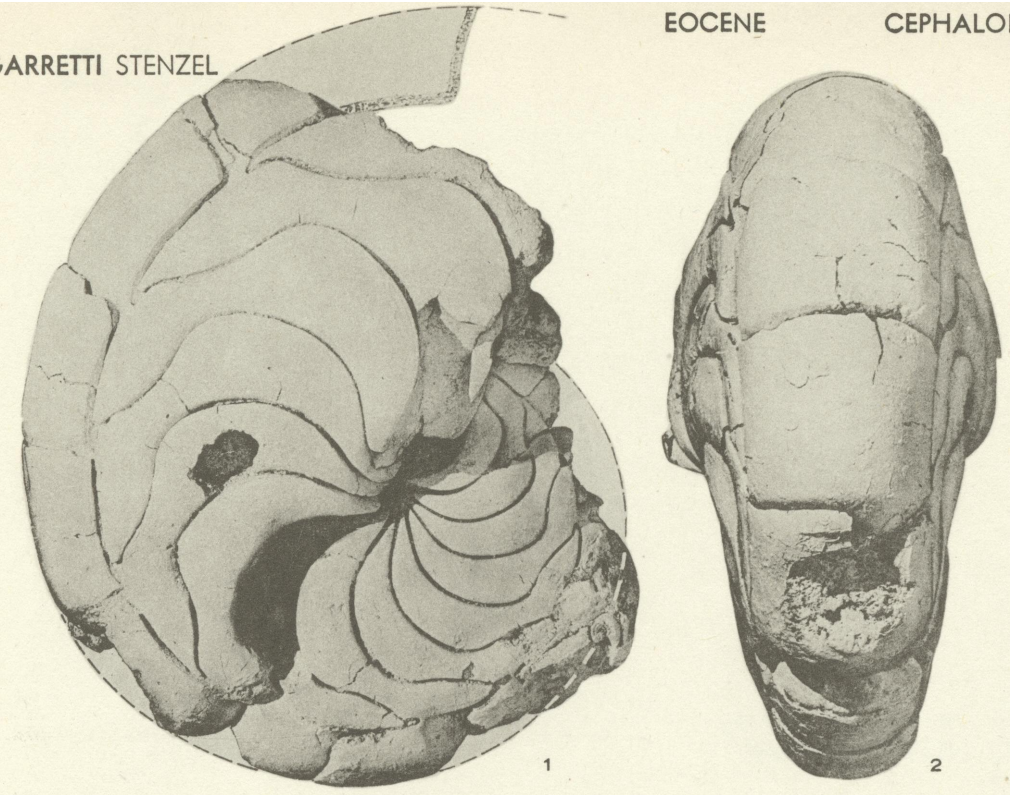


Figs. 1a, 1b—ventral and lateral views, holotype, X 1,
Figs. 1c, 1d—ventral and lateral views, paratype 2, X 1;
Stenzel 1935.

Text fig. 125(5)—cross section, diameter 99 mm., holotype,
Text fig. 126(4)—suture, X 0.95, metatype; Stenzel 1940.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

GARRETTI STENZEL



Figs. 1, 2—two views of entire monotype, X ½,
Fig. 3—cross-sectional view of part of monotype, X ½,
Text fig. 125(6)—cross section, diameter 169 mm.,
Text fig. 126(3)—suture, X 0.33, monotype; Stenzel 1940.

Type Data: Monotype, No. 2001, Geology Museum, Louisiana State Univ., Baton Rouge, Louisiana.

ATURIA

Synonymy:

1940 *Aturia (Brazaturia) garretti* Stenzel, H. B., Tertiary nautiloids from the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 772–773, pl. 42, figs. 1–3, text figs. 125(6), 126(3).

Original Description: The type is a large internal mold composed of brown clay-ironstone. Shell involute, compressed, and flat lenticular in shape. Cross section of whorl high and narrow, widest near the umbilical shoulder. Umbilical shoulder indistinct. Umbilical zone narrow, occupying about one-eighth of the total height of the whorl. Lateral zones almost flat from the umbilical shoulder to the region of the lateral lobes, converging at an angle of 30 degrees; venter regularly rounded. Umbilicus deep and narrow in the mold; whether it was closed in the original shell cannot be determined.

Septa convex apicad, broadly invaginated at the lateral lobes, less so at the large siphuncle. Septa 13 in the last preserved whorl. Sutures fairly straight across the venter; a small narrow saddle at the ventral corner of the base of the lateral lobe; lateral lobes stout but tapering to a slender, pinched-in, and recurved end; lateral saddle highly arched with the sharpest curvature at the turning point to the lateral lobe. Successive sutures touch with the point of the lateral lobe onto the preceding saddle at the base of the lateral lobe.

Dimensions.—Greatest preserved diameter approximately 17 cm. At a diameter of 12.4 cm. the following measurements were obtained: larger radius 7.6 cm., smaller radius 4.8 cm., greatest thickness 5.2 cm., whorl increase ratio 2.49, ratio thickness over diameter 0.423.

Original Remarks: Aturia garretti differs from other members of the genus occurring in the Claiborne group of the Gulf Coast region by its very much more compressed cross section and to a certain extent also by its very low whorl increase ratio. It differs from *Aturia alabamensis* (Morton) from the Jackson group of the Gulf Coast by its much lower whorl increase ratio, 2.49, in comparison with 3.40 to 3.262 for *Aturia alabamensis*, but it is somewhat similar to the latter species through its low ratio of thickness over diameter.

Type Locality: Left bank of Saline Bayou, at railroad trestle of Louisiana Railway & Navigation Company at St. Maurice, southwestern Winn Parish, Louisiana, sec. 15, R. 6 W., T. 9 N., Louisiana Meridian.

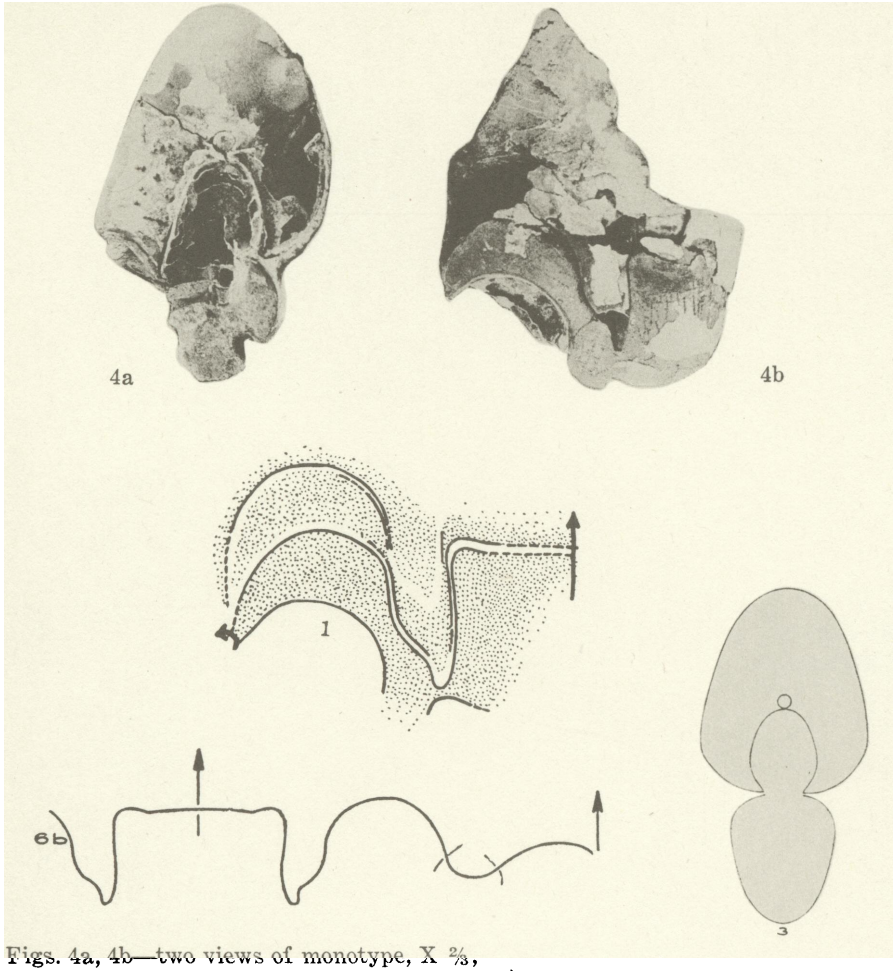
Geologic Horizon: Saline Bayou member of Cook Mountain formation, Claiborne group, middle Eocene. For stratigraphy of type locality see Huner, J., Jr., Geology of Caldwell and Winn parishes: Louisiana Geol. Survey, Geol. Bull. 15, p. 98, 1939.

Distribution: Only one specimen known.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

LATICLAVIA STENZEL

ATURIA



Figs. 4a, 4b—two views of monotype, X ⅔,
Fig. 1—sutures of monotype, X ¾; Stenzel 1935.
Fig. 125(3)—cross section of monotype, diameter 93 mm.,
Fig. 126(6b)—suture of monotype, X 0.57; Stenzel 1940.

Type Data: Monotype in Stenzel collection, Austin, Texas.

Type Locality: Bald Mound, 0.5 mile northwest of Hopewell Negro Church and school, on abandoned and now partly impassable Centerville-Jewett road, 4.83 miles northwest of Centerville; H. R. Bensor 50-acre tract, R. Woods survey, Leon County, Texas (Bureau of Economic Geol. locality No. 145-T-43). Compare Stenzel, H. B., The Geology of Leon County, Texas: Univ. Texas Pub. 3818, p. 262, 266 and map, pl. 1, 1939.

Synonymy:

1935 *Aturia (Brazaturia) laticlavia* Stenzel, H. B., Nautiloids of the genus Aturia from the Eocene of Texas and Alabama: Jour. Paleontology, vol. 9, p. 558–559, pl. 63, figs. 4a, 4b, text fig. 1.

1940 Stenzel, H. B., Tertiary nautiloids from the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 773–774, text figs. 125(3), 126(6a, 6b).

Original Description: The specimen is a sectoral fragment containing parts of two whorls. Shell of last whorl involute, widest at a point one-fourteenth of the height of the whorl removed from the umbilicus; widest point not at umbilical shoulder, but about twice the width of the umbilical zone removed from the umbilicus; sides gently curved from the umbilical shoulder to beyond the lateral lobes, converging approximately at an angle of 36°; venter regularly and rather sharply rounded. The penultimate whorl does not appear any more inflated than the last whorl.

Septa convex apicad, broadly invaginated for the lateral lobes, less so for the subdorsan siphuncle; fairly numerous, probably 18 to 21 in the last whorl. Suture straight across the venter; lateral lobes fairly broad, short, at one place almost parallel-sided and pinched in at the end; lateral saddles very highly arched.

Growth lines not observable in this specimen.

Dimensions: Height of first preserved whorl, 19 mm., greatest thickness, 15 mm.; height of second preserved (or last) whorl, 55 mm., median height, 32 mm., greatest width, 42 mm. Length of lateral lobe in last whorl, 23 mm., width at base, 9 mm.

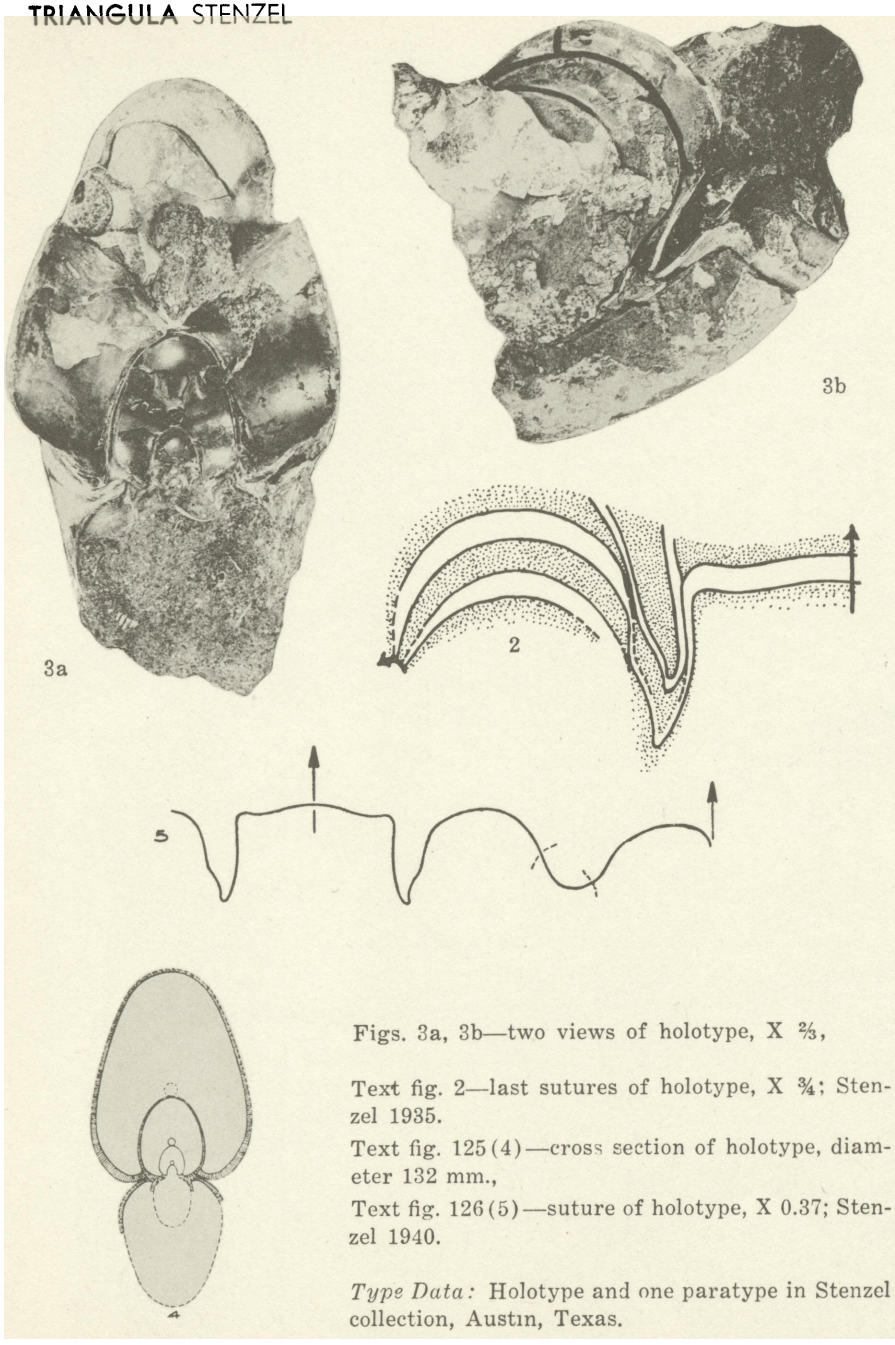
Original Remarks: This species differs from *A. triangula* in its broader, more inflated cross section; the lower number of septa per whorl; and the much shorter, plumper, lateral lobes. From *A. brazoensis* it differs not so much in the shape as in the sutures. The very highly arched lateral saddle is not found in the other two new species.

Geologic Horizon: Limestone bed in Tyus member of Weches formation, Claiborne group, middle Eocene.

Distribution: Known also from the oyster bed of *Ostrea lisbonensis* Harris in the lower Cane River glauconitic marl, Claiborne group, middle Eocene, in Natchitoches Parish, Louisiana (compare Stenzel 1940, p. 774).

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

TRIANGULA STENZEL



Figs. 3a, 3b—two views of holotype, X ⅔,

Text fig. 2—last sutures of holotype, X ¾; Stenzel 1935.

Text fig. 125(4)—cross section of holotype, diameter 132 mm.,

Text fig. 126(5)—suture of holotype, X 0.37; Stenzel 1940.

Type Data: Holotype and one paratype in Stenzel collection, Austin, Texas.

ATURIA

Synonymy:

1935 *Aturia (Brazaturia) triangula* Stenzel, H. B., Nautiloids of the genus Aturia from the Eocene of Texas and Alabama: Jour. Paleontology, vol. 9, p. 557–558, pl. 63, figs. 3a, 3b, text fig. 2.

1940 Stenzel, H. B., Tertiary nautiloids from the Gulf Coastal Plain: Univ. Texas Pub. 3945, text figs. 125(4), 126(5).

Original Description: The specimen is a fragment containing sectors of five successive whorls. Shell of last preserved whorl involute, widest at the umbilical shoulder, of roughly triangular cross section; the narrow umbilical zone occupying about one-eleventh of the total height of the whorl. Umbilical shoulder distinct; sides straight from the umbilical shoulder to beyond the lateral lobes, converging at an angle of 40°; venter regularly and rather sharply rounded. Penultimate whorl inflated, much less triangular in cross-section, as the straight sides are proportionately shorter and the curvature of the venter proportionately gentler. Cross section of the third whorl similar to the fourth or penultimate. Second whorl almost crescentic in cross section, owing to the extreme shortness of the straight sides, which extend from the umbilical shoulder to the region of the lateral lobes. First whorl almost globular.

Septa convex apicad, broadly invaginated for the lateral lobes, less so for the siphonal collars; numerous, probably 22 in the last preserved whorl. Sutures nearly straight across the venter, with small saddle at ventral base of lateral lobe; lateral lobes slender, long, gently tapering, pinched in near the point; lateral saddles uniformly curved. Successive sutures touch or almost touch at several places along the lateral lobes.

Most of the growth lines are not observable.

Dimensions: First whorl, height, 2 mm.; second whorl, height, 4 mm., median height, 2.5 mm., greatest thickness, 4 mm.; third whorl, height, 12 mm., median height, 7 mm., greatest thickness, 9 mm.; fourth whorl, height, 30 mm., median height, 19 mm., greatest thickness, 24 mm.; fifth whorl, height, 78 mm., median height, 50 mm., greatest thickness, 64 mm. Length of lateral lobe in last (fifth) whorl, 34 mm., width at base, 11 mm.

Original Remarks: This species differs from the other species of *Aturia* described below [*Aturia brazoensis* Stenzel, *At. laticlavia* Stenzel] in its nearly triangular and less inflated cross section and the greater number of septa per whorl. The septa are also more crowded and have longer and more slender lateral lobes.

Type Locality: Bald Mound, 0.5 mile northwest of Honewell Negro Church and school, on abandoned and now partly impassable Centerville-Jewett road, 4.83 miles northwest of Centerville; H. R. Benson 50-acre tract, R. Woods survey, Leon County, Texas (Bureau of Economic Geol. locality No. 145–T–43). Compare Stenzel, H. B., The Geology of Leon County, Texas: Univ. Texas Pub. 3818, p. 262, 266 and map, pl. 1, 1939.

Geologic Horizon: Limestone bed in Tyus member of Weches formation, Claiborne group, middle Eocene.

Distribution: Tyus member of Weches formation, Claiborne group, middle Eocene.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

TURNERI STENZEL

ATURIA

Type Data: Monotype in Stenzel collection, Austin, Texas.

Type Locality: Bluffs along Ridge Creek about 1 mile above the Missouri, Kansas and Texas Railroad trestle and the county road bridge, 6.2 miles west of Smithville or 0.8 mile east of Upton, in east part of R. Andrews survey, Bastrop County, Texas (Bureau of Economic Geology locality No. 11–T–7). This locality is also the type locality of *Deltoidonautilus elliotti* Stenzel.

Geologic Horizon: Marquez shale member, Reklaw formation, Claiborne group, middle Eocene. This specimen was found in a concretionary, discontinuous, fossiliferous, lenticular, impure limestone, which is about 44 feet below the top of the Marquez shale.

Distribution: Only one specimen known.

Synonymy:

1940 *Aturia (Brazaturia) turneri* Stenzel, H. B., Tertiary nautiloids from the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 770–772, pl. 41, figs. 1–6, text figs. 125(2), 126(7).

Original Description: Shell involute, compressed, and flat lenticular in shape. Cross section of whorls triangulate-oval in the early whorls, becoming gradually broader at the venter and resulting in a subrectangular cross section of the last preserved whorl. Early whorls widest at or near the umbilical shoulder, but last preserved whorl widest in the region from the vicinity of the umbilical shoulder to the middle of the lateral zones. Umbilical shoulder not well defined; umbilical zone occupying about 1/8 of the total height of the earlier whorls, and 1/9 of the total height of the last preserved whorl. Lateral zones are only gently curved in the earlier whorls and converge at an angle of 29 degrees; lateral zones of the last preserved whorl gently curved and nearly parallel from the vicinity of the umbilical shoulder to their middle, but converging at an angle of 32 degrees from their middle on toward the venter. Venter broadly and evenly rounded.

Septa convex apicad, invaginated for the lateral lobes and the comparatively narrow siphuncular funnels. Septa 13 in the last preserved whorl.

Sutures slightly wavy across venter; a small narrow saddle at the ventral corner of the base of the lateral lobe; lateral lobes rapidly tapering and pinched in at the point which is recurved dorsally; lateral saddle evenly arched.

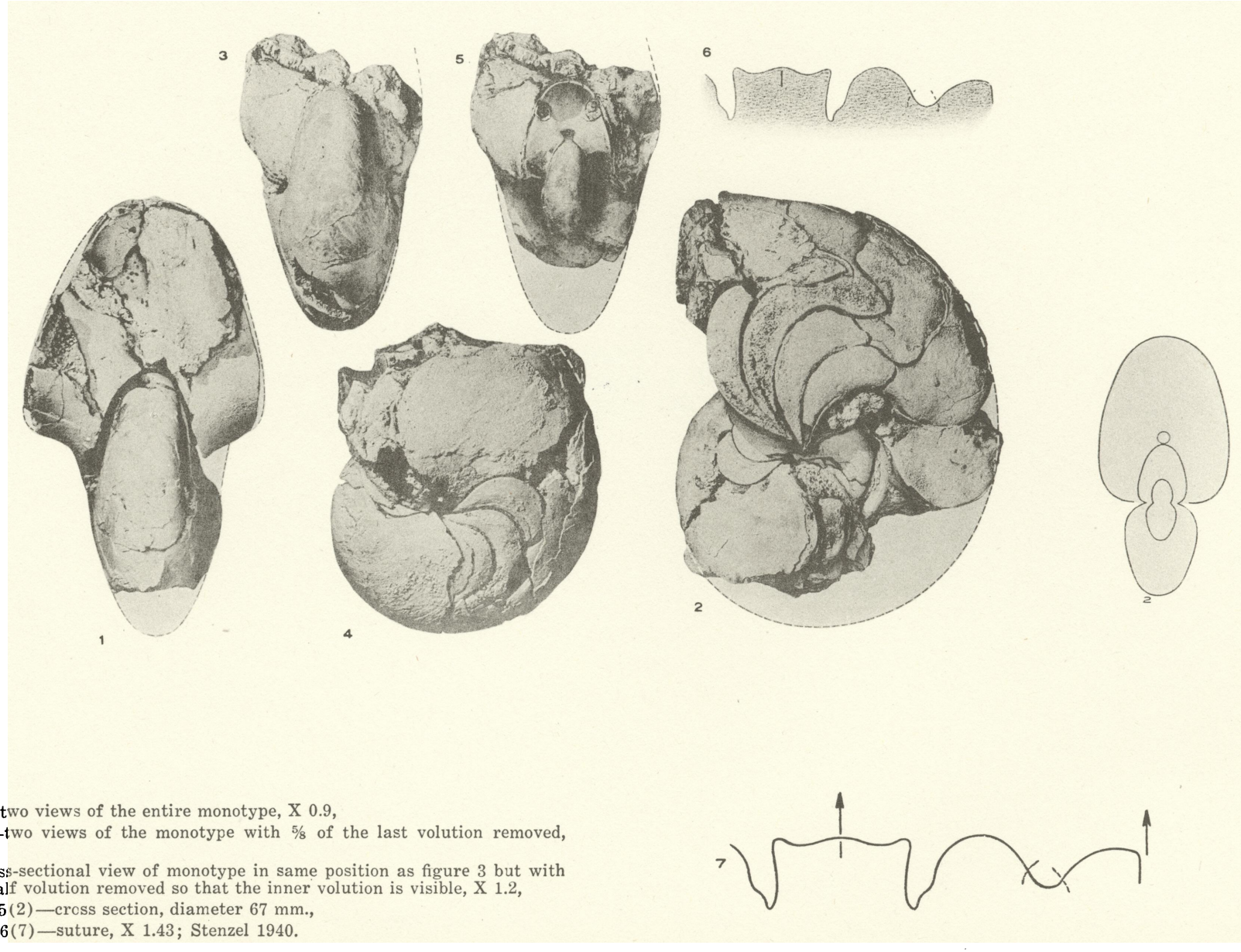
Growth lines with a deep and narrow, but well rounded hyponomic sinus.

Dimensions.—Greatest preserved diameter 8.5 cm. (in part calculated). At a diameter of 6.65 cm. the following measurements were obtained: larger radius 4.3 cm., smaller radius 2.35 cm., inner radius 1.5 cm., greatest thickness 3.3 cm., whorl increase ratio 2.87, ratio thickness over diameter 0.496.

Original Remarks: Aturia turneri differs from other members of the genus occurring in the Claiborne group of the Gulf Coast region by its unusual cross section. It is rather broad near the venter of the last whorl so that the cross section of that whorl is subrectangular. All other Aturias from the Eocene of the Gulf Coastal Plain have more converging lateral zones, which give the cross section a more triangulate or ovate shape.

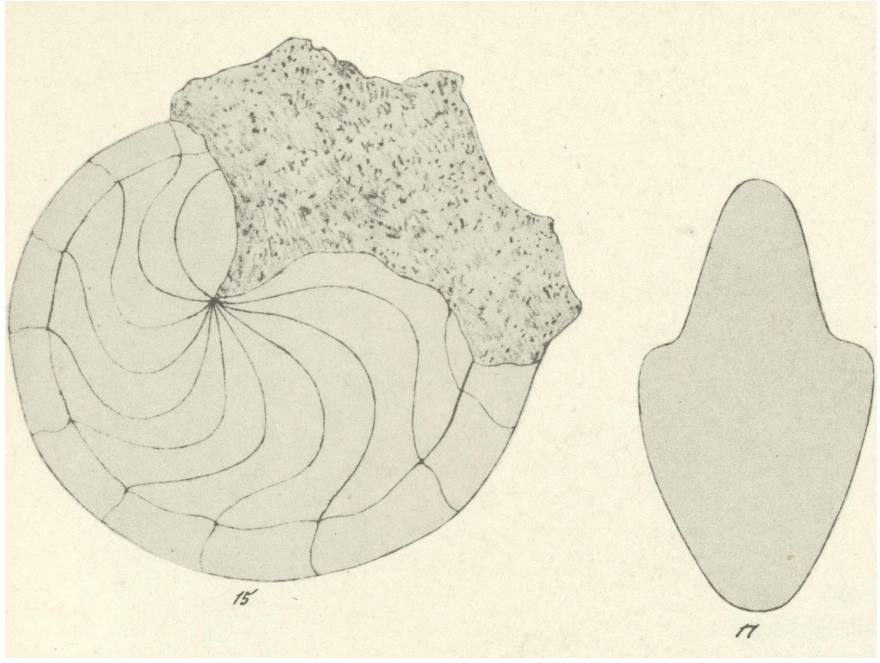
Another feature characteristic of *Aturia turneri* is the dorsal lobe of the suture. Plate 41, figure 5, is a photograph of the interior mold of an air chamber and shows the dorsal portion of the suture as it appears in interior molds. The dorsal lobe is comparatively wide and large for a middle Eocene Aturia. This lobe is similar to the dorsal lobe of *Aturia (Nilaturia) praeziczac* Oppenheim. In the latter species the dorsal lobe is even wider. *Aturia (Nilaturia) praeziczac* is a "primitive" species of the genus and *Aturia turneri* is somewhat transitional to *Nilaturia* in that feature. However, *Aturia turneri* differs clearly from *Aturia (Nilaturia) praeziczac* by the lateral, tongue-shaped lobes. In *Aturia praeziczac* the ends of these lobes are rounded; in *At. turneri* they are pointed and hooked toward the dorsum as is the case in typical *Brazaturia* and *Aturia.*

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.



Figs. 1, 2—two views of the entire monotype, X 0.9,
Figs. 3, 4—two views of the monotype with ⅝ of the last volution removed, X 1.2,
Fig. 5—cross-sectional view of monotype in same position as figure 3 but with the front half volution removed so that the inner volution is visible, X 1.2,
Text fig. 125(2)—cross section, diameter 67 mm.,
Text fig. 126(7)—suture, X 1.43; Stenzel 1940.

VANUXEMI (CONRAD)



Figs. 15, 17—Conrad 1848.

Type Data: Unknown.

Type Locality: Long Branch, Monmouth County, New Jersey.

Geologic Horizon: Shark River marl, middle Eocene.

Distribution; Shark River marl of New Jersey.

Synonymy:

1848 *Nautilopsis vanuxemi* Conrad, T. A., Observations on the Eocene formation, and descriptions of one hundred and five new fossils of that period, from the vicinity of Vicksburg, Mississippi, with an Appendix: Acad. Nat. Sci. Philadelphia, Proc. for 1847, p. 299.

1848 *Pelagus vanuxemi,* Conrad, T. A., Observations on the Eocene formation, and descriptions of one hundred and five new fossils of that period, from the vicinity of Vicksburg, Mississippi; with an Appendix: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 1, p. 130, pl. 14, figs. 15, 17.

1865 *Aturia vanuxemi,* Conrad, T. A., Catalogue of the Eocene and Oligocene Testacea of the United States: Am. Jour. Conchology, vol. 1, p. 15.

1868 Conrad, T. A., *in* Cook, G. H., Geology of New Jersey, p. 732, 377 and text fig.

1892 Whitfield, R. P., Gasteropoda and Cephalopoda of the Raritan clays and greensand marls of New Jersey: U. S. Geol. Survey Mon. 18, p. 287–288, pl. 49, figs. 1–3, pl. 50, fig. 1.

Original Description: In Vanuxem's collection there is a cast, from the Eocene near Long Branch, N.J., resembling *Nautilus zig-zag,* (Sow.) It is more compressed than that species, and the angles of the septa appear to be in contact near the periphery. It is more like a Goniatite than a Nautilus, and may properly constitute a genus, which I propose to name Nautilopsis.

Length 2¾. Diameter 1 5–16.

Revised Description: Shell involute, compressed. Cross section of whorl high and narrow, widest at or near umbilical shoulder which is indistinct. Umbilical zones narrow occupying about ⅛ of the total height of the whorl; lateral zones nearly flat; venter rounded and narrow.

Septa convex apicad, invaginated for the lateral lobes and around the siphuncle. Septa 13 to 16 in adult whorl. Sutures slightly arched forward at the venter ending in a small saddle at the corner leading to the tongue-shaped lateral lobes; lateral lobes broad, pinched-in and hooked-in at the point; lateral saddle broadly arched. Successive sutures touch. Siphonal invaginations large. Size up to 16.5 cm.

Observations: All specimens of this species are pressure-deformed internal molds of greensand. The species is known insufficiently.

This species is the genotype of *Nautilopsis* Conrad 1848 by original designation.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

EUREIA STENZEL & TURNER

CRYPTOCHORDA

Figs. 3, 4—holotype, X 3.

Type Data: Holotype and fragmentary paratypes in Stenzel collection, Austin, Texas.

Type Locality: Gully 0.15 mile north of Concord-Centerville county road, 2.11 miles east of Robbins crossroads, right tributary of McDaniel Creek, 0.1 mile east of a fence and 0.15 mile west of east line of J. E. Morris 89-acre tract, International & Great Northern Railroad Company survey, Leon County, Texas; Bureau of Economic Geology locality No. 145-T-36. See map in Stenzel, H. B., The geology of Leon County, Texas: Univ. Texas Pub. 3818, 1939.

Geologic Horizon: Viesca glauconitic marl member of Weches formation, Claiborne group, middle Eocene.

Distribution: Viesca member of Weches formation in Robertson, Leon, and Houston counties, Texas.

Synonymy:

1931 *Cryptochorda (Buccinum) mohri*, Stenzel, H. B., *in* Renick, B. C., & Stenzel, H. B., The lower Claiborne on the Brazos River, Texas: Univ. Texas Bull. 3101, p. 106. [Not *Cryptochorda Mohri* (Aldrich).]

1940 *Cryptochorda eureia* Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 800–801, pl. 43, fig. 3.

Original Description: Shell solid, ovoid; spire low, nearly one-third the length of the shell. Protoconch consists of 3 smooth, convex, naticoid whorls. Spire whorls convex, polished, and covered on the anterior part by an extension of the parietal enamel. Body whorl ovoid, excavated at the base, polished. Some specimens, but not the holotype, have four impressed spirals at the base of body whorl. Aperture wide, oval, deeply emarginate at the base, extending into an anal canal at the posterior end; outer lip only slightly retractive, smooth within, thickened and slightly reflected at the outside, slightly sigmoid in outline, ending at the posterior in an obtuse shoulder point, which is separated from the body whorl by the shallow anal canal; base of aperture deeply notched at the base of an ill-defined canal. Siphonal fasciole flat and well defined toward the body whorl by a narrow ridge. Columella with a slight vertical ridge which shows the contour of the siphonal fasciole buried under the enamel. Parietal callus heavy, spreading over nearly the entire apertural face of the body whorl, extending in posterior direction beyond the suture onto the preceding whorl.

Dimensions.—Holotype, length 37 mm.; width 20 mm.

Original Observations: This species has a shorter spire and thicker and wider spread parietal callus than *Cr. stenostoma* Stenzel & Turner.
The specific name is the feminine gender of the Greek adjective εὐρύς, broad, and refers to the broad shape of the species.

MOHRI (ALDRICH)

CRYPTOCHORDA

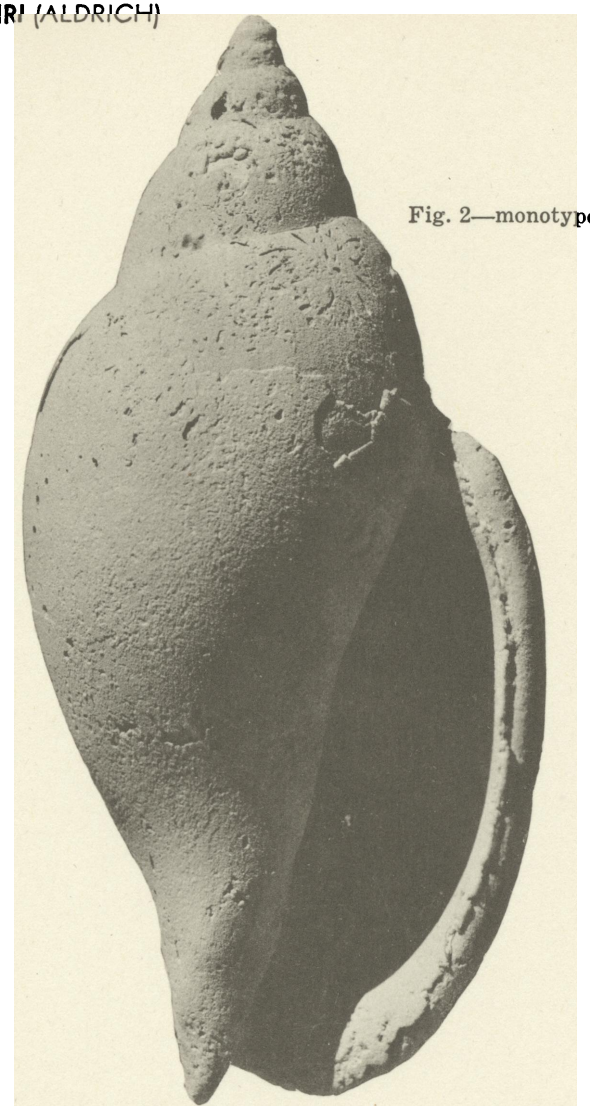


Fig. 2—monotype, X 3.

Type Data: Monotype in Aldrich collection, Geological Department, The Johns Hopkins Univ., Baltimore, Maryland.

Type Locality: Lisbon bluff, about 1 mile south of Lisbon Landing on right bank of Alabama River, Monroe County, Alabama.

Geologic Horizon: Lisbon formation, Claiborne group, middle Eocene.

Distribution: Only one specimen known.

Synonymy:

1886 *Buccinum mohri* Aldrich, T. H., Preliminary report on the Tertiary fossils of Alabama and Mississippi: Alabama Geol. Survey, Bull. 1, p. 26, pl. 3, figs. 16, 16a.

1893 *Cryptochorda mohri*, Cossmann, M., Notes complémentaires sur la faune éocénique de l'Alabama: Annales de Géologie et Paléontologie, livr. 12, p. 38.

1899 Cossmann, M., Essais de paléoconchologie comparée, livr. 3, p. 78.

1931 Not *Cryptochorda (Buccinum) mohri*, Stenzel, H. B., *in* Renick, B. C. & Stenzel, H. B., The lower Claiborne on the Brazos River, Texas: Univ. Texas Bull. 3101, p. 106. [= *Cryptochorda eureia* Stenzel & Turner.]

1940 *Cryptochorda mohri*, Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 798–800, pl. 43, fig. 2.

Original Description: Shell rather solid; spire high; apex obtuse; whorls seven, rounded; suture rather shallow; surface smooth. Lines of growth coarse, showing on the body whorl. Outer lip strongly reflected, slightly shouldered at its junction with the body whorl. Aperture semi-lunate nearly two-thirds the length of the shell, smooth internally, terminating in a short, excised canal.

Locality.—Lisbon, Ala.

This species has some resemblance to *Buccinum stromboides*, Herm., from the Calcaire Grossier, of Grignon, but lacks the striations on the lower part of the body whorl, is less swollen in outline, and has a more strongly reflected outer lip. Named in honor of Dr. Chas. Mohr, of Mobile, Ala.

Revised Description: Shell solid, slender ovoid; spire medium, more than one-third of the length of the shell. Tip of protoconch broken in monotype specimen; remaining whorls smooth, convex, naticoid. Spire whorls convex, polished, covered on the anterior part by an extension of the parietal enamel. Body whorl ovoid, excavated at base, polished. Monotype specimen has no impressed spirals at the base of the body whorl. Aperture wide, oval, broadly emarginate at the base, extending into an anal canal at posterior end; outer lip slightly decorticated in monotype specimen, vertical except for the basal part which is recurved into the canal, smooth within, thickened and slightly reflected at the outside, nearly uniformly arched in outline, ending at the posterior into a slight, obtuse shoulder point, which is separated from the body whorl by the shallow anal canal; base of aperture broadly and only medium deeply notched at the base of an ill-defined, wide canal. Siphonal fasciole flat and well defined toward the body whorl by a narrow ridge. Columella with a slight vertical swelling. Parietal callus heavy, spreading over the entire apertural face of the body whorl, extending in posterior direction beyond the suture onto the preceding whorl.

Dimensions: Monotype, length without tip of protoconch 47 mm.; width 23 mm.

Observations: *Cryptochorda mohri* (Aldrich) has a longer and slenderer spire than either *Cr. eureia* Stenzel & Turner or *Cr. stenostoma* Stenzel & Turner. The aperture of *Cr. mohri* is wider than in the two new species, particularly so at its posterior end. The outer lip of *Cr. mohri* has less of a shoulder at its posterior junction and is not sigmoid in outline when viewed onto the apertural face.

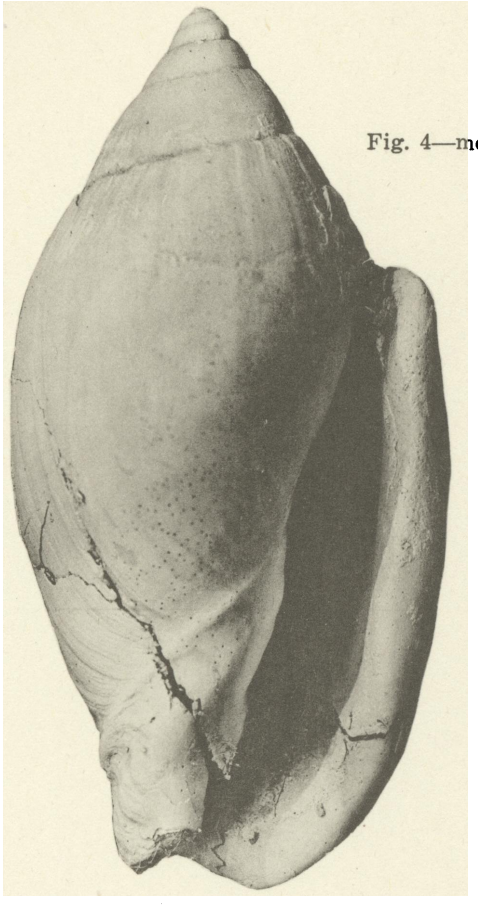


Fig. 4—monotype, X 3.

Type Data: Monotype (Cat. No. 17641) in Bureau of Economic Geology, The University of Texas, Austin, Texas. The type was collected by Mr. Carl Chelf of the Texas Memorial Museum.

Type Locality: Bluff on right bank of Colorado River upstream from highway bridge at Smithville, Bastrop County, Texas; Bureau of Economic Geology locality No. 11–T–2.

Geologic Horizon: Viesca glauconite marl member of Weches formation, Claiborne group, middle Eocene.

Distribution: Known only from type locality.

Synonymy:

1937 *Cryptochorda mohri,* Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 399 in part, pl. 65, figs. 9, 10.

1940 *Cryptochorda stenostoma* Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 802–803, pl. 43, fig. 4.

Original Description: Shell solid, slender ovoid; spire low, less than one-third the length of the shell. Protoconch consists of 4 smooth, convex, naticoid whorls, of which the first 2 are much smaller than in *Cryptochorda eureia* Stenzel & Turner. Spire whorls slightly convex, polished, and covered on the anterior half by an extension of the parietal enamel. Body whorl slender ovoid, excavated at the base, polished. Aperture narrow, widest near the anterior end, deeply emarginate at the base, extending into an anal canal at the posterior end; outer lip only slightly retractive, smooth within, thickened and sharply reflected at the outside, slightly sigmoid in outline, ending at the posterior in a rectangular shoulder point, which is separated from the body whorl by the distinct anal canal; base of aperture deeply notched at the end of an ill-defined canal. Siphonal fasciole flat and well defined toward the body whorl by a narrow ridge. Columella with a pronounced, humpy, vertical ridge which is in part responsible for the narrowness of the aperture. Parietal callus thin, spreading over part of the apertural face of the body whorl, extending to about halfway between the posterior suture and the posterior end of the aperture. In the type specimen the parietal callus has numerous small holes arranged in lines presumably caused by boring sponges.

Dimensions.—Monotype, length 39 mm., width 19 mm.

Original Observations: The specimen figured by Palmer belongs to this species. This species is characterised by the pronounced vertical ridge along the columella. This ridge is present in every member of this genus, even in the type species, *Cr. stromboides* (Hermann); but in no other species is it so high and well developed. The outer lip of this species is more nearly vertical if viewed on the apertural face of the body whorl (see Pl. 43, fig. 4); but when seen from the side it is more sigmoidal in outline than in any other species. The spire differs from that in other known species of *Cryptochorda* by its slightly convex profile and the lesser inflation of the whorls.

The specific name of the species is derived from the Greek adjective στενός, narrow, and noun στόμα, mouth or opening, and refers to the narrow aperture of the species.

CANCELLATA STENZEL & TURNER

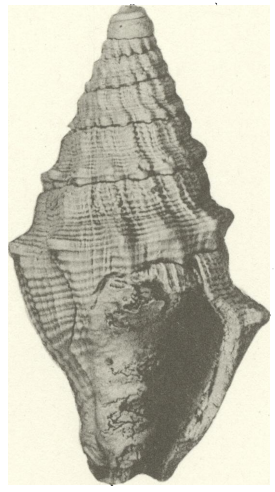


Fig. 2—monotype, X 3.

Type Data: Monotype (Cat. No. 17643) in Bureau of Economic Geology, The University of Texas, Austin, Texas.

Type Locality: Cut and ditch on east side of Negreet-Columbus road on steep, wooded blackland hill, 7.15 miles from the school at Negreet, Sabine Parish, Louisiana; Bureau of Economic Geology locality No. La-19.

Geologic Horizon: Cook Mountain formation, Claiborne group, middle Eocene.

Distribution: Only one specimen known.

Synonymy:

1940 *Lapparia cancellata* Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 815–816, pl. 44, fig. 2.

Original Description: Shell heavy, comparatively short; apical angle 43°; spire nearly one-half the length of the shell. Protoconch stubby ovoid in outline, comparatively small, consists of 2½ polished whorls with deeply channelled sutures; the first 2 whorls are depressed and bluntly keeled and their slopes posterior to the keel are concave, the last half volution of the protoconch has slightly convex and vertical sides. First nepionic whorl with 14 retractive axial ribs which develop nodes and become shouldered after about half a volution. The nodes gradually develop into flattened spines and the axial ribs disappear in later spire whorls. Spire whorls with a slight subsutural collar and steeply sloping spinous shoulder placed immediately behind the suture; spines 10 on last preserved whorl of monotype, their tips slightly flattened parallel with the direction of coiling; suture distinct and wavy due to its position near the spines of the preceding whorl, numerous fine wavy spiral threads overrun the whorls and make a cancellate pattern with the raised threads of the growth lines. Body whorl ovoid with steeply sloping spinous shoulder and excavated base; fine wavy threads over entire body whorl but somewhat wider spaced in the excavated basal portion. Growth lines numerous and raised producing a cancellate pattern with the spirals over entire body whorl except the excavated base. Aperture narrow, deeply emarginate at the base; outer lip broken; deeply notched base of aperture extends into a short, twisted canal. Siphonal fasciole convex, wrinkled with growth lines, and spirally twisted. Columella bears 4 strong folds, which are badly decorticated in the monotype. Parietal wash thin; the parietal wall is slightly resorbed at the aperture.

Dimensions.—Monotype, length of broken specimen, 21 mm., width 10 mm.

Original Observations: This species is near related to *Lapparia mooreana* (Gabb). It differs from that species by the concave protoconch whorls, the more sunken spire, and the prominently cancellate ornamentation.

The specific name refers to the cancellate ornamentation, which is much more striking in this species than in any other *Lapparia*.

CRASSA STENZEL & TURNER

LAPPARIA

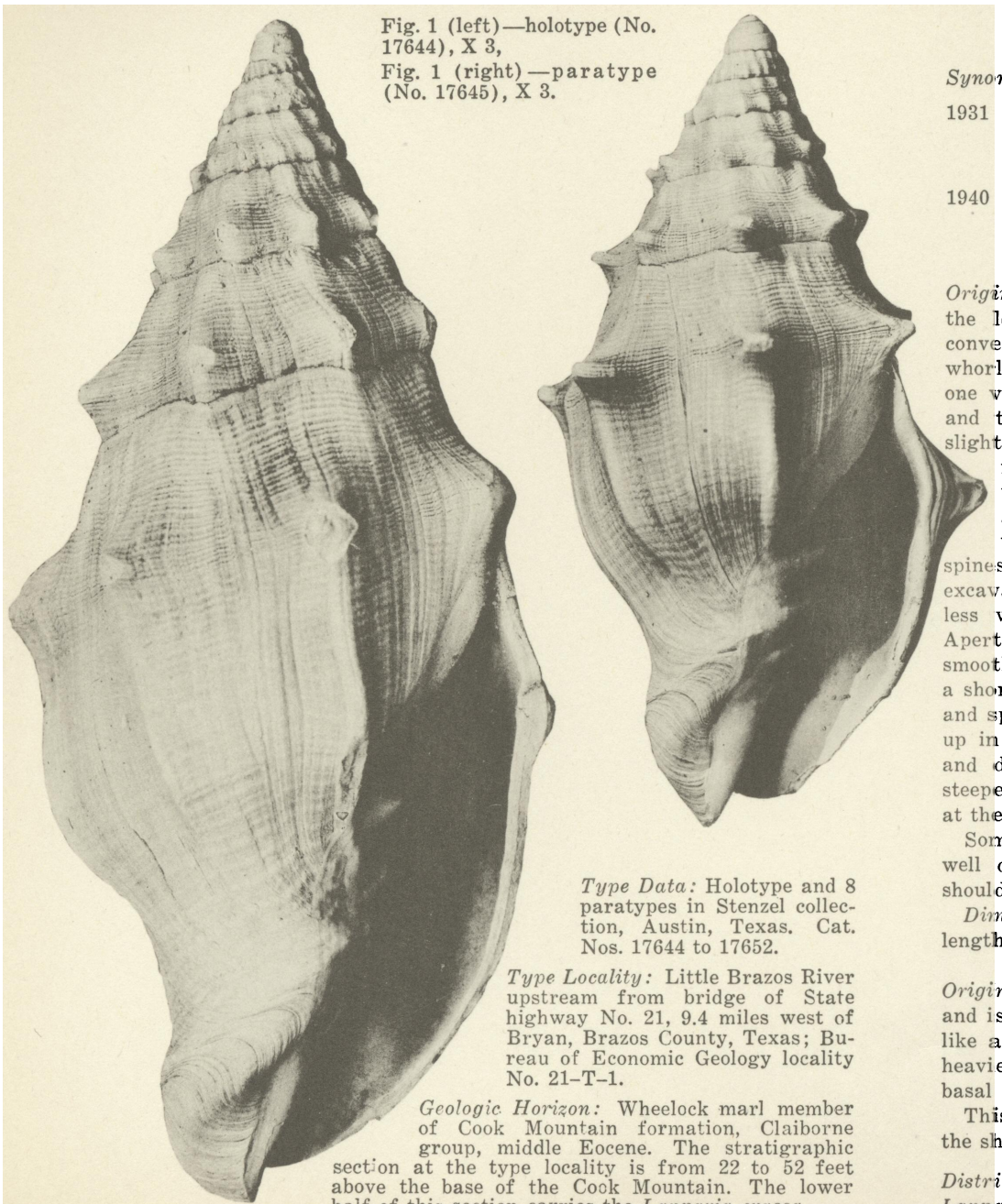


Fig. 1 (left)—holotype (No. 17644), X 3,
Fig. 1 (right)—paratype (No. 17645), X 3.

Type Data: Holotype and 8 paratypes in Stenzel collection, Austin, Texas. Cat. Nos. 17644 to 17652.

Type Locality: Little Brazos River upstream from bridge of State highway No. 21, 9.4 miles west of Bryan, Brazos County, Texas; Bureau of Economic Geology locality No. 21-T-1.

Geologic Horizon: Wheelock marl member of Cook Mountain formation, Claiborne group, middle Eocene. The stratigraphic section at the type locality is from 22 to 52 feet above the base of the Cook Mountain. The lower half of this section carries the *Lapparia crassa*.

Synonymy:

1931 *Mitra* n.sp. aff. *mooreana*, Stenzel, H. B., *in* Renick, B. C., & Stenzel, H. B., The lower Claiborne on the Brazos River, Texas: Univ. Texas Bull. 3101, p. 95, 101 in part.

1940 *Lapparia crassa* Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 813–814, pl. 44, fig. 1, pl. 45, fig. 1.

Original Description: Shell heavy; apical angle 47°; spire less than one-half the length of the shell. Protoconch large, ovoid, consists of 3 polished, convex, and naticoid whorls with deeply channelled sutures. First nepionic whorl with about 20 retractive axial ribs which develop nodes after about one volution. The nodes gradually develop into flattened, prominent spines and the axial ribs persist usually to the last whorl. Spire whorls with a slight, wrinkled subsutural collar and steeply sloping spinous shoulder placed near the anterior suture; spines generally only 7 to 8 per whorl, their tips flattened parallel with the direction of coiling; numerous fine, wavy spirals overrun the whorls and are alternating in size occasionally. Body whorl ovoid with a steeply sloping spinous shoulder and excavated base; spines usually buttressed anteriorly by narrow axial ribs extending to the excavated base; fine, wavy spirals well developed at and posterior to the spines, less well developed toward the base; growth lines strong and numerous. Aperture narrow, deeply emarginate at the base; outer lip not retractive, smooth within, and sharp-edged; deeply notched base of aperture extends into a short, twisted canal. Siphonal fasciole convex, wrinkled with growth lines, and spirally twisted. Columella bears 4 strong folds, which spiral all the way up in the shell; the 4 folds are arranged according to increasing strength and decreasing inclination, the most anterior fold being the weakest and steepest of the four. Parietal wash thin; the parietal wall is slightly resorbed at the aperture.

Some specimens of this species lose the axial ribs suddenly. The holotype has well developed and large axial ribs on the body whorl, but the last two shoulder spines do not have any axial ribs.

Dimensions.—Holotype, length 57 mm., width 24 mm.; figured paratype, length 39 mm., width 20 mm.

Original Observations: This species occurs with *Lapparia mooreana* (Gabb) and is distinguished from it by the much larger protoconch and the buttress-like axial ribs which give it a swollen appearance. This is the largest and heaviest *Lapparia* species with the exception of *Lapparia*, n.sp., from the basal Weches formation.

This specific name *crassa*, fat, is chosen to emphasize the swollen shape of the shell.

Distribution: Known only from type locality, where it is much rarer than *Lapparia mooreana* (Gabb).

DUMOSA (CONRAD)

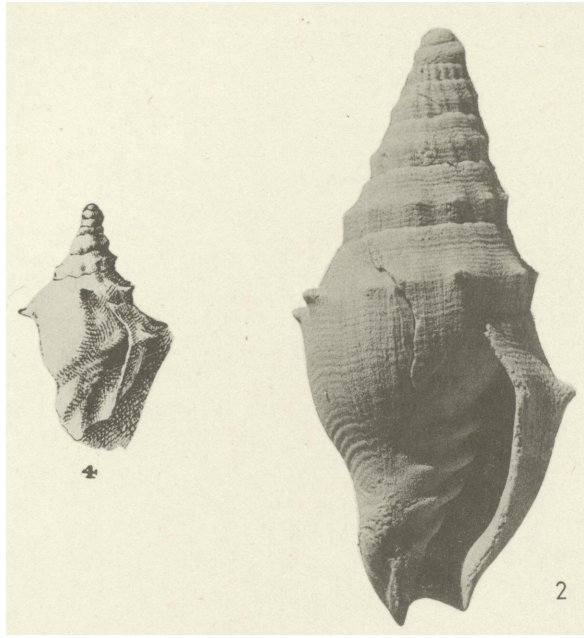


Fig. 4—Conrad 1854.
Fig. 2—topotype (No. 17653), X 3.

Type Data: Syntypes, No. 13575, in Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania. Figured topotype (Pl. 45, fig. 2) in Stenzel collection, Austin, Texas.

Type Locality: Moodys Branch, cliff on right bank of branch, near intersection of Peachtree Street and Poplar Boulevard, in northern part of Jackson, Hinds County, Mississippi.

Geologic Horizon: Moodys marl, Jackson group, upper Eocene.

Distribution: Moodys marl at the base of Jackson group, upper Eocene, in Mississippi and Louisiana.

Observations (Stenzel & Turner 1940): This species is the genotype of the genus *Lapparia*. There is a complete gradation between typical *Lapparia dumosa* (Conrad) and *L. dumosa exigua* Palmer, both forms being end members of variation in the same species. *Lapparia dumosa* is easily distinguished from *L. dumosa exigua* by its prominent spines. The figured topotype of *L. dumosa* is not quite typical being not very prominently spinose. Specimens like the figured topotype are very similar to *Lapparia mooreana*, but have a larger protoconch, a thicker columella, a siphonal fasciole and columellar folds more nearly at a right angle to the vertical axis, and more subdued spiral threads, and lack the wrinkles on the subsutural collar. The latter two features make *L. dumosa* appear much smoother-surfaced than *L. mooreana*.

This species is the genotype of *Lapparia* Conrad 1855 by monotypy.

Synonymy:

1854 *Mitra dumosa* Conrad, T. A., *in* Wailes, B. L. C., Report on the Agriculture and Geology of Mississippi, p. 289, pl. 15, fig. 4.

1855 *Mitra (Lapparia) dumosa* Conrad, T. A., Observations on the Eocene deposit of Jackson, Miss., with descriptions of thirty-four new species of shells and corals: Acad. Nat. Sci. Philadelphia Proc., vol. 7, p. 260.

1865 *Lapparia dumosa*, Conrad, T. A., Catalogue of the Eocene and Oligocene Testacea of the United States: Am. Jour. Conchology, vol. 1, p. 24.

1866 Conrad, T. A., Check list of the invertebrate fossils of North America; Eocene and Oligocene: Smith. Misc. Coll., vol. 7, no. 200, p. 16.

1890 *Lapparia pactilis*, in part, Dall, W. H., Contributions to the Tertiary fauna of Florida, with especial reference to the Miocene Silex-beds of Tampa and the Pliocene beds of the Caloosahatchie River: Wagner Free Inst. Sci., Trans., vol. 3, pt. 1, p. 79.

1899 *Lapparia dumosa*, *Cossmann, M.*, *Ess*ais de paléoconchologie comparée, vol. 3, p. 111, 112, text fig. 14, pl. 8, fig. 8.

1937 Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 286, pl. 62, figs. 1, 3.

1940 Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 819–820, pl. 45, fig. 2.

Original Description (Conrad 1855): Short-fusiform, volutions seven, direct, obliquely flattened above, with a series of transversely compressed, distant spines on the two largest whorls; on the contiguous whorl they become nodules; two whorls below the apex papillary, smooth; the next two longitudinally ribbed, and the others longitudinally striated or with prominent lines of growth; whole surface with revolving wrinkled lines; plaits four; beak profoundly ridged.

Revised Description: Shell heavy, slender; apical angle 37° to 40°; spire nearly one-half the length of the shell. Protoconch ovoid in outline, large, consists of 2½ polished, convex, and naticoid whorls with deeply channelled sutures. First nepionic whorl with about 20 retractive axial ribs which develop nodes and become shouldered after about one volution. The nodes gradually develop into flattened spines and the axial ribs disappear in later spire whorls. Spire whorls with a slight subsutural collar and steeply sloping spinous shoulder placed at the anterior third of the whorl; spines generally 11 per whorl, their tips flattened parallel with the direction of coiling; numerous fine wavy spirals overrun the whorls. Body whorl ovoid with steeply sloping spinous shoulder and excavated base; fine wavy spirals well developed over entire body whorl but somewhat wider spaced in the excavated basal portion. Growth lines smooth and numerous. Aperture narrow, deeply emarginate at the base; outer lip not retractive, smooth within, sharp-edged; deeply notched base of aperture extends into a short, twisted canal. Siphonal fasciole convex, wrinkled with growth lines, and spirally twisted. Columella bears 4 strong folds, which spiral all the way up in the shell; the 4 folds are arranged according to increasing strength and decreasing inclination, the anteriormost fold being the weakest and steepest of the four. Parietal wash thin; the parietal wall is slightly resorbed at the aperture.

Dimensions: Figured topotype, length 27 mm., width 11 mm.

DUMOSA VAR. **EXIGUA** PALMER

LAPPARIA

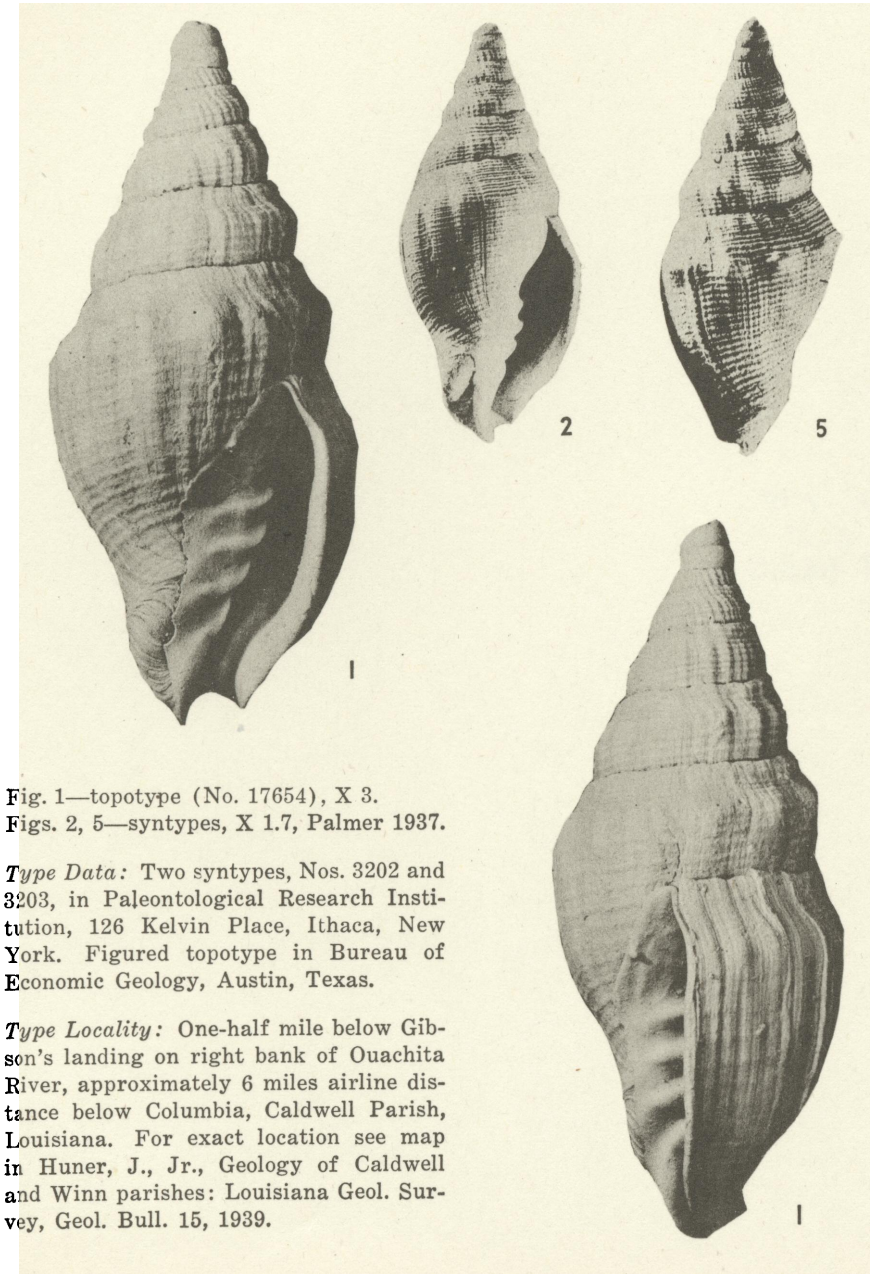


Fig. 1—topotype (No. 17654), X 3.
Figs. 2, 5—syntypes, X 1.7, Palmer 1937.

Type Data: Two syntypes, Nos. 3202 and 3203, in Paleontological Research Institution, 126 Kelvin Place, Ithaca, New York. Figured topotype in Bureau of Economic Geology, Austin, Texas.

Type Locality: One-half mile below Gibson's landing on right bank of Ouachita River, approximately 6 miles airline distance below Columbia, Caldwell Parish, Louisiana. For exact location see map in Huner, J., Jr., Geology of Caldwell and Winn parishes: Louisiana Geol. Survey, Geol. Bull. 15, 1939.

Synonymy:

1937 *Lapparia dumosa* var. *exigua* Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 386–387, pl. 62, figs. 2, 5.

1940 Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 821–822, pl. 45, figs. 4, 6, 8, 9.

Original Description: Shell stout; nucleus typical; general characters shown by the illustration.

The variety differs from *L. dumosa* in the absence of large spines and in having slightly coarser spiral threads over the entire surface. Some specimens have incipient nodes or poorly developed spinose nodes on the body whorl or lower whorls of the spire. While *dumosa* has 6–8 spines, *exigua* has 10 or more nodes.

Although the young *L. pactilis* is spirally striate, the adult is smooth. Some specimens are nodose. *L. exigua* differs from *pactilis* in being coarsely striate, and in the character of the obscure nodes. The nodes in *L. exigua* when present are incipient spines and are situated as in *L. dumosa*, near the midline of the whorls. In *L. pactilis* they are longitudinal and extend from the midline to the suture below. They are the remnants of longitudinal folds which are stronger in the adolescent stages.

Dimensions.—Syntype, No. 3202, length 31 mm., width 13 mm.; syntype, No. 3203, length 32 mm., width 14 mm.; figured topotype, length 31.4 mm., width 14.2 mm.

Observations (Stenzel & Turner 1940): There is a complete gradation between typical *Lapparia dumosa* (Conrad) and *L. dumosa exigua* Palmer, both forms being end members of variation in the same species. *Lapparia dumosa* is easily distinguished from *L. dumosa exigua* by its prominent spines.

Geologic Horizon: Moodys marl, Jackson group, upper Eocene.

Distribution: Moodys marl at base of Jackson group, upper Eocene, in Mississippi and Louisiana.

ELONGATA STENZEL & TURNER

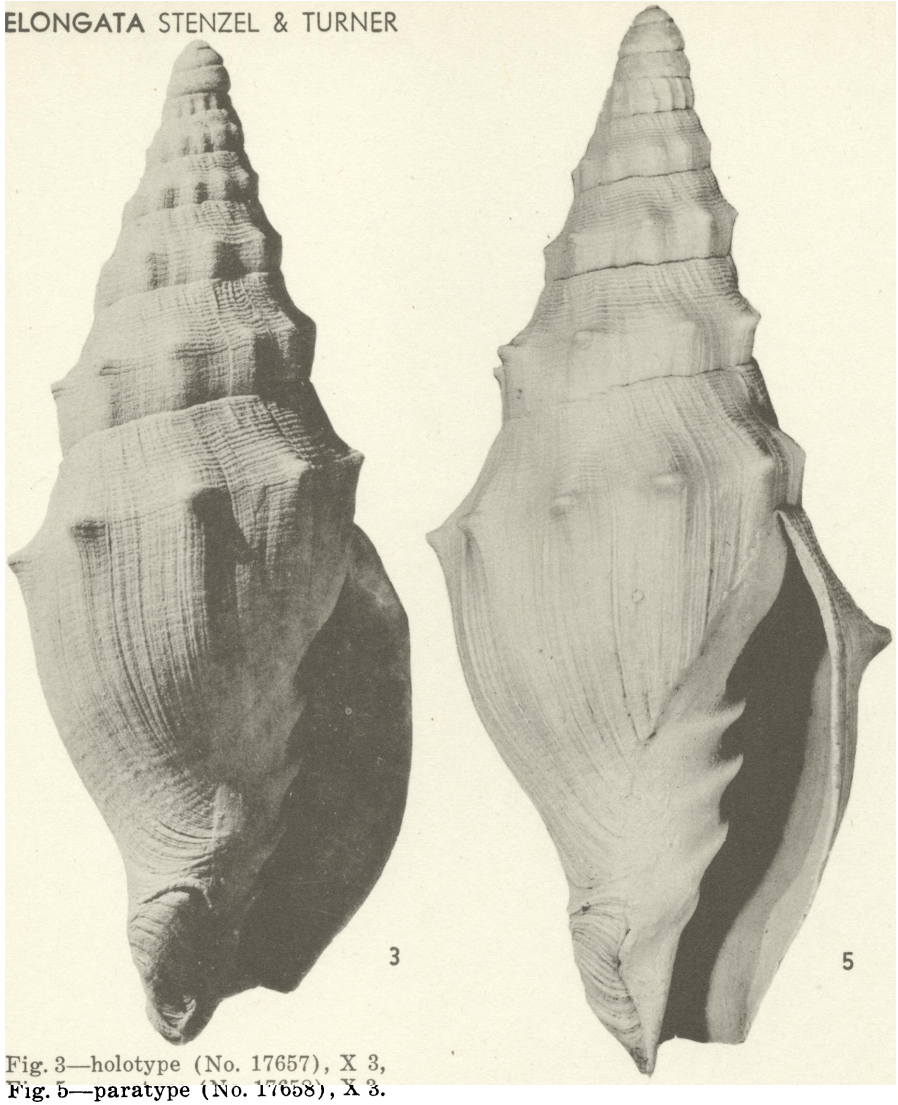


Fig. 3—holotype (No. 17657), X 3,
Fig. 5—paratype (No. 17658), X 3.

Type Data: Holotype and numerous paratypes in Stenzel collection, Bureau of Economic Geology, Austin, Texas. (Cat. Nos. 17657 to 17678.)

Type Locality: Bluff on right bank of Colorado River upstream from highway bridge at Smithville, Bastrop County, Texas; Bureau of Economic Geology locality No. 11–T–2.

Geologic Horizon: Viesca glauconitic marl member of Weches formation, Claiborne group, middle Eocene.

Distribution: Viesca glauconitic marl member of Weches formation, Claiborne group, middle Eocene, from the Brazos to the Colorado River, in Texas.

LAPPARIA

Synonymy:

1899 *Lapparia mooreana*, Cossmann, M., Essais de paléoconchologie comparée, livr. 3, p. 112, pl. 8, fig. 9.

1931 *Mitra* cf. *dubia*, Stenzel, H. B., *in* Renick, B. C., & Stenzel, H. B., The lower Claiborne on the Brazos River, Texas: Univ. Texas Bull. 3101, p. 106.

1937 *Lapparia mooreana*, in part, Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 387–388; pl. 62, figs. 8, 12, 13 only.

1940 *Lapparia elongata* Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 806–808, pl. 44, figs. 3, 5.

Original Description: Shell heavy, slender; apical angle 32° to 35°, spire nearly one-half of the length of the shell. Protoconch consists of 4 whorls of which the first two are polished, convex, and naticoid with deeply channelled sutures; the next two have very faint spiral ribs and deeply channelled sutures; the last of the 4 whorls is smaller that the preceding whorl; outline of protoconch ovoid. First nepionic whorl with about 15 retractive axial ribs which develop nodes and become shouldered after half a volution. The nodes gradually develop into flattened spines and the axial ribs disappear in later spire whorls. Spire whorls with a slight, wrinkled subsutural collar and steeply sloping spinous shoulder placed at the anterior third of the whorl; spines generally 7 to 10 per whorl, their tips flattened parallel with the direction of coiling; numerous fine wavy spirals overrun the whorls and are usually alternating in size. Body whorl ovoid with a steeply sloping spinous shoulder and excavated base; fine, wavy spirals well developed posterior to and at the spines, but obsolete toward the base; growth lines strong and numerous. Aperture narrow, deeply emarginate at the base; outer lip not retractive, smooth within, and sharp-edged; deeply notched base of aperture extends into a short, twisted canal. Siphonal fasciole convex, wrinkled with growth lines, and spirally twisted. Columella bears 4 strong folds, which spiral all the way up in the shell; the 4 folds are arranged according to increasing strength and decreasing inclination, the most anterior fold being the weakest and steepest of the four. Parietal wash thin; the parietal wall is slightly resorbed at the aperture.

Dimensions.—Holotype, length 48 mm., width 17 mm.; figured paratype, length 45 mm., width 16 mm.

Original Observations: This Weches species is the slenderest of all Lapparias. It differs from the Crockett species *Lapparia mooreana* (Gabb) by its larger protoconch, slenderer spire, and wider zone between the shoulder spines and the anterior suture on the spire whorls. It differs from the Weches species *L. nuda* Stenzel & Turner by the more pronounced spirals on the body whorl, the early disappearance of the axial ribs, and the slenderer shape. The specific name is chosen to emphasize the slender shape of the shell.

Cossmann figured this species under the name *Lapparia mooreana* (Gabb), stating erroneously that it came from the Paleocene Midway stage.

GEORGIANA (CONRAD)

LAPPARIA

Fig. 4—Conrad 1850.

Type Data: Unknown.

Type Locality: Georgia. It is not known in which part of Georgia this fossil was collected. Some of the other Eocene fossils described by Conrad in the same article and collected by the same collector, J. Hamilton Couper, are said to come either from white limestone or Burr-stone of Palmyra, Lee County, or limestone of Bainbridge, Baker County.

Geologic Horizon: Unknown.

Synonymy:

1850 *Mitra georgiana* Conrad, T. A., Descriptions of one new Cretaceous, and seven new Eocene fossils: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 2, pt. 1, p. 39, pl. 1, fig. 4.

1937 *Lapparia pactilis* [in part], Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 385.

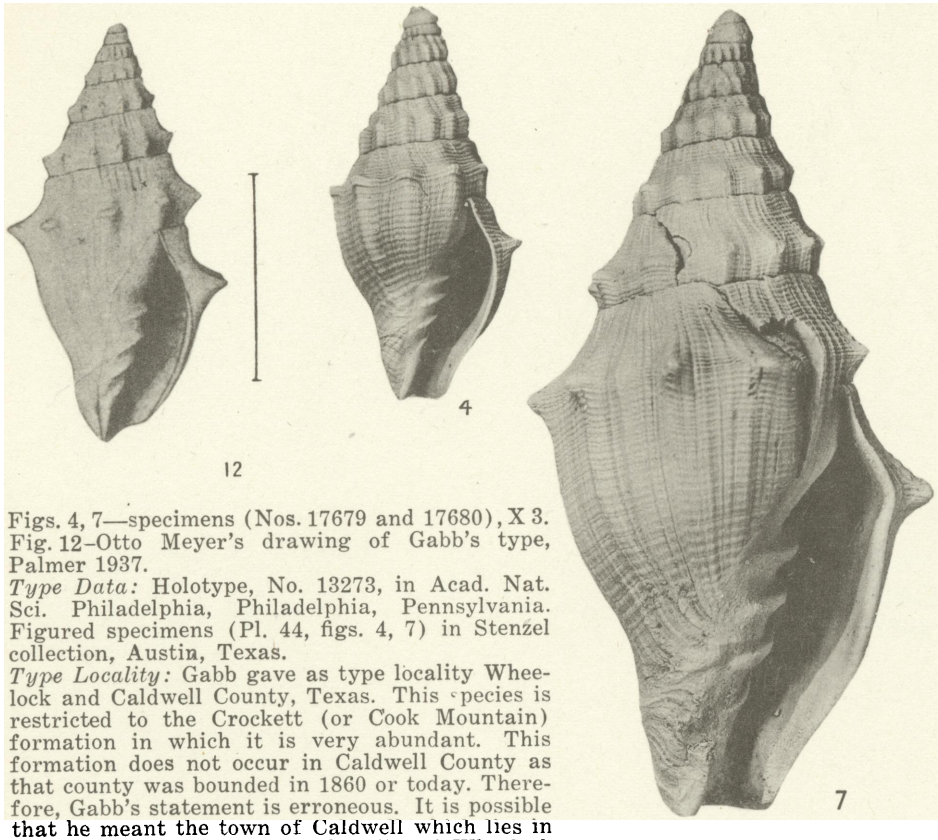
1940 *Lapparia georgiana,* Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 822.

Original Description: Fusiform; spire turreted; volutions five or six, tuberculated, tubercles acute and extending over the inferior half of each volution; upper portion contracted and angulated; suture impressed; aperture elliptical, about half as long as the shell; columella with four plaits.

Observations (Stenzel & Turner 1940): Lack of material from Georgia makes is impossible to add to the original description of the species. Until additional material is found in Georgia or until the type becomes available for study the species remains doubtful.

MOOREANA (GABB)

LAPPARIA



Figs. 4, 7—specimens (Nos. 17679 and 17680), X 3. Fig. 12–Otto Meyer's drawing of Gabb's type, Palmer 1937.

Type Data: Holotype, No. 13273, in Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania. Figured specimens (Pl. 44, figs. 4, 7) in Stenzel collection, Austin, Texas.

Type Locality: Gabb gave as type locality Wheelock and Caldwell County, Texas. This species is restricted to the Crockett (or Cook Mountain) formation in which it is very abundant. This formation does not occur in Caldwell County as that county was bounded in 1860 or today. Therefore, Gabb's statement is erroneous. It is possible that he meant the town of Caldwell which lies in Burleson County, Texas. Caldwell and Wheelock are only 32 miles apart and lie on the Old Spanish Road, which was at that time a main route of travel. There are many Cook Mountain formation localities near both towns and along the Old Spanish Road between them. One of these localities is presumably the type locality where Dr. Francis Moore obtained the specimens. Kennedy, William, The Eocene Tertiary of Texas east of the Brazos River: Acad. Nat. Sci. Philadelphia, Proc. for 1895, p. 122, 1896, stated that many of Gabb's types came from Town Branch of Cedar Creek near Wheelock. The locality on this branch was visited and was found to be exceedingly poor collecting. Unless this locality was much better 45 to 80 years ago it is doubtful that this is Gabb's locality. Other localities, on the Old Spanish Road, are much better.

Geologic Horizon: Wheelock marl member of Cook Mountain formation, Claiborne group, middle Eocene.

Distribution: Wheelock and lower Landrum members of Cook Mountain formation in east Texas; Cook Mountain formation of Louisiana; Wautubbee formation of Mississippi; Claiborne group, middle Eocene.

Dimensions (Stenzel & Turner 1940): Larger figured specimen, length 35 mm., width 16 mm.; smaller figured specimen, length 18 mm., width 8 mm. (see Pl. 44, figs. 4, 7). Holotype, length 27 mm.

Synonymy:

1860 *Mitra mooreana* Gabb, W. M., Descriptions of new species of American Tertiary and Cretaceous fossils: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 4, pt. 4, p. 383, pl. 67, fig. 24.

1865 *Lapparia mooreana*, Conrad, T. A., Catalogue of the Eocene and Oligocene Testacea of the United States: Am. Jour. Conchology, vol. 1, p. 24.

1866 Conrad, T. A., Check list of the invertebrate fossils of North America; Eocene and Oligocene: Smith. Misc. Coll., vol. 7, no. 200, p. 16.

1899 Not *Lapparia mooreana*, Cossmann, M., Essais de paléoconchologie comparée, livr. 3, p. 112, pl. 8, fig. 9, 1899 = *L. elongata* Stenzel & Turner.

1931 *Mitra mooreana* + *Mitra mooreana* var., Stenzel, H. B., *in* Renick, B. C., & Stenzel, H. B., The lower Claiborne on the Brazos River, Texas: Univ. Texas Bull. 3101, p. 95, 101.

1937 *Lapparia mooreana*, in part, Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 387–388, pl. 62, figs. 9, 11, 14, and 15 only.

1940 Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 809–813, pl. 44, figs. 4, 7, 8.

Original Description: Shell subfusiform, whorls eight, apex mamillated, suture distinct; mouth about half the length of the shell, outer lip sharp, inner lip heavy, four large folds on the columella; surface marked by short spinous nodes on the angle of the whorls (about eight on the body whorl), and by numerous fine revolving lines, crossed by prominent lines of growth.

Revised Description (Stenzel & Turner 1940): Shell heavy, slender; apical angle 38° to 44°; spire nearly one-half the length of the shell. Protoconch ovoid in outline, comparatively small, consists of 2 to 2½ polished, convex, and naticoid whorls with deeply channelled sutures; the last quarter volution of the protoconch and the succeeding half volution of the juvenile whorls is smaller than the preceding whorl. First nepionic whorl with about 21 retractive axial ribs which develop nodes and become shouldered after about half a volution. The nodes gradually develop into flattened spines and the axial ribs disappear in later spire whorls. Spire whorls with a slight, wrinkled subsutural collar and steeply sloping spinous shoulder placed at the anterior third of the whorl; spines generally 8 to 9 per whorl on adults, their tips flattened parallel with the direction of coiling; numerous fine wavy spirals overrun the whorls and are usually alternating in size. Body whorl ovoid with steeply sloping spinous shoulder and excavated base; fine, wavy spirals well developed posterior to and at the spines, but obsolete toward the base in some specimens; growth lines strong and numerous. Aperture narrow, deeply emarginate at the base; outer lip not retractive, smooth within, and sharp-edged; deeply notched base of aperture extends into a short, twisted canal. Siphonal fasciole convex, wrinkled with growth lines, and spirally twisted. Columella bears 4 strong folds, which spiral all the way up in the shell; the 4 folds are arranged according to increasing strength and decreasing inclination, the most anterior fold being the weakest and steepest of the four. Parietal wash thin; the parietal wall is slightly resorbed at the aperture.

Observations (Stenzel & Turner): This species is characterized by the comparatively small protoconch having few volutions and by the disappearance of the axial ribs in the later whorls. *Lapparia crassa* Stenzel & Turner, which occurs with *L. mooreana* (Gabb) at the type locality of the former, is readily distinguished by the much larger protoconch, the persistence of ribs to the last whorl, and its heavier outline; *L. nuda* Stenzel & Turner is readily differentiated from *L. mooreana* by the lack of the spiral threads, the larger protoconch, the persistence of the ribs to the last whorl, and its slightly stouter appearance; *L. elongata* Stenzel & Turner differs from *L. mooreana* by its larger protoconch, more elevated spire, and larger size. *Lapparia nuda* and *L. elongata* are not found in the same beds as *L. mooreana*.

NUDA STENZEL & TURNER

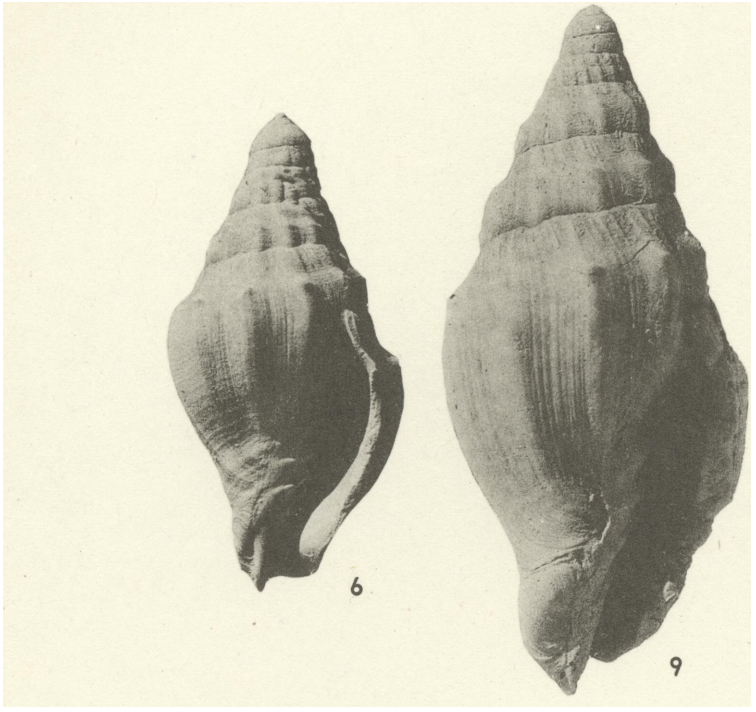


Fig. 6—paratype, X 3,
Fig. 9—holotype, X 3.

Type Data: Holotype and 14 paratypes in Stenzel collection, Austin, Texas. Cat. Nos. 17681 to 17695.

Type Locality: Bluff on right bank of Colorado River upstream from highway bridge at Smithville, Bastrop County, Texas; Bureau of Economic Geology locality No. 11–T–2.

Geologic Horizon: Viesca glauconitic marl member of Weches formation, Claiborne group, middle Eocene.

Distribution: Viesca member of Weches formation, Claiborne group, middle Eocene, in Bastrop, Leon, and Houston counties, Texas.

Synonymy:

1937 *Lapparia mooreana,* in part, Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda, and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 387–388, pl. 62, fig. 10 only.

1940 *Lapparia nuda* Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 808–809, pl. 44, figs. 6, 9.

Original Description: Shell heavy; apical angle 41° to 44°, spire about one-half the length of the shell. Protoconch consists of 3½ whorls which are polished, convex, and naticoid with deeply channelled sutures; the last quarter volution of the protoconch and the succeeding half volution of the juvenile whorls is smaller than the preceding whorl; outline of protoconch ovoid. First nepionic whorl with about 19 retractive axial ribs which develop nodes and become shouldered after half a volution. The nodes gradually develop into slightly flattened, inconspicuous spines and the axial ribs persist to the last whorl. Spire whorls with a slight subsutural collar much wrinkled with growth lines, a steeply sloping noded shoulder placed usually near the middle of the whorl; ribs and nodes generally 9 to 11 per whorl, the node tips slightly flattened parallel with the direction of coiling; fine spiral lines usually lacking; if present they are developed best on the posterior shoulder slope. Body whorl ovoid with a steeply sloping noded shoulder and excavated base; axial ribs much narrower than the interspaces extend to the base where they gradually die out in the excavated portion. Aperture narrow, deeply emarginate at the base; outer lip not retractive, smooth within, and sharp-edged; deeply notched base of aperture extends into a short twisted canal. Siphonal fasciole convex, wrinkled with growth lines, and spirally twisted. Columella bears 4 strong folds, which spiral all the way up the shell; the 4 folds arranged according to increasing strength and decreasing inclination, the most anterior fold being the weakest and steepest of the four. Parietal wash thin; the parietal wall is slightly resorbed at the aperture.

Dimensions.—Holotype, length 31 mm., width 14 mm.; figured paratype, length 21 mm., width 10 mm.

Original Observations: This Weches species occurs together with *L. elongata* Stenzel & Turner. It may be distinguished from the latter by its greater apical angle, stouter outline, lack of spiral threads, more strongly wrinkled subsutural collar, and the persistence of the axial ribs even to the last whorl.

The specific name *nuda* refers to the absence of the spiral threads, a feature which distinguishes this species from other, ribbed Lapparias.

Prepared by H. B. Stenzel & F. E. Turner, Bureau of Economic Geology, Austin, Texas.

EOCENE

PACTILIS (CONRAD)

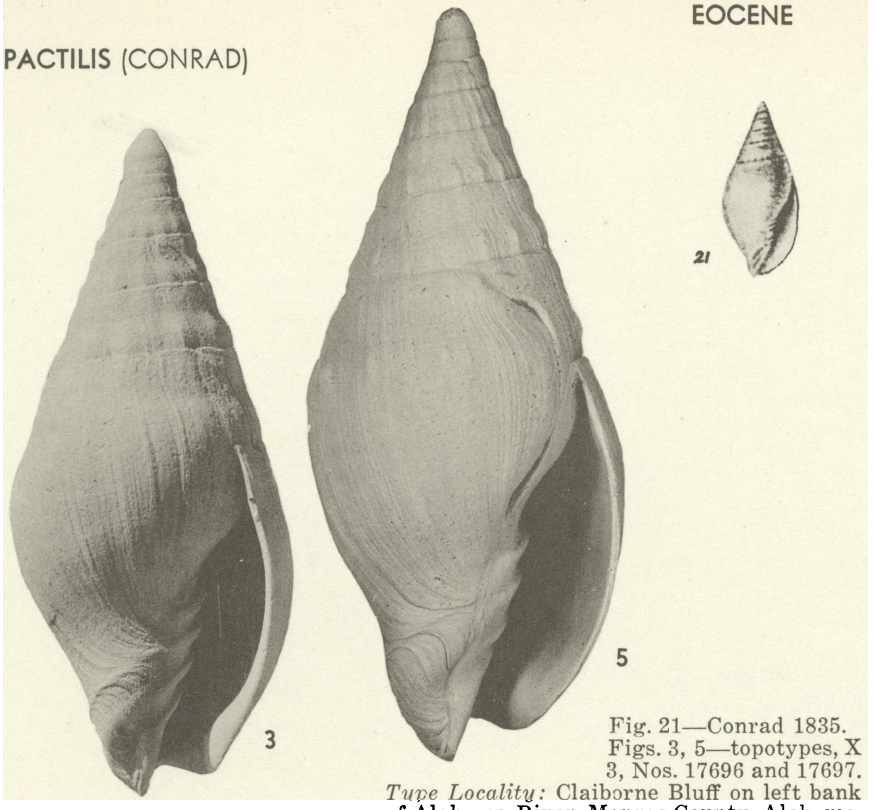


Fig. 21—Conrad 1835.
Figs. 3, 5—topotypes, X 3, Nos. 17696 and 17697.

Type Locality: Claiborne Bluff on left bank of Alabama River, Monroe County, Alabama.

Geologic Horizon: Gosport sand, Claiborne group, middle Eocene.

Distribution: Presumably widely distributed in the Gosport sand of Alabama. Reported by Gardner, Julia, Recent collections of upper Eocene Mollusca from Alabama and Mississippi: Jour. Paleontology, vol. 13, p. 343, 1939, from the Gosport sand of Little Stave Creek, in secs. 8 and 9, T. 7 N., R. 2 E., 4½ miles north of Jackson, Clarke County, Alabama.

Observations (Stenzel & Turner 1940): This species is farthest in evolution from the original spinose stock of the genus. It is characterized by the absence of spines, the nearly complete absence of a shoulder, and the nearly complete absence of spiral threads on the body whorl. The nodes of *L. pactilis*, if present, are elongate in the direction of the growth lines while in other Lapparias they are elongate parallel with the direction of coiling.

As pointed out by De Gregorio and confirmed by Cossmann, *Lapparia pactilis* is very similar to *Mitreola labratula* (Lamarck) (see pl. 45, fig. 7). This similarity is indeed quite remarkable. Nevertheless, the differences between these two species are large enough and significant enough to separate them in different, although related, genera. *Mitreola labratula* has a thickened and slightly reflected outer lip, the parietal and columellar callus are thick in comparison with *Lapparia*. The outer lip of *Mitreola labratula* is slightly swollen at one place forming an indistinct tooth which is more pronounced in other species of the genus. The protoconchs of *Mitreola* and *Lapparia* are very similar. The chief differences between these two genera lie in the apertural characters. However, it should be pointed out that species of the genus *Lapparia* other than the extreme species, *L. pactilis* (Conrad), are not at all similar to *Mitreola* species in general appearance.

GASTROPODA 12

LAPPARIA

Synonymy (partial):

1833 *Mitra pactilis* Conrad, T. A., Fossil shells of the Tertiary formations of North America, p. 46.

1835 Conrad, T. A. [republication of Conrad 1833], p. 43, pl. 16, fig. 21.

1840 *Voluta dubia* Lea, H. C., Descriptions of some new species of fossil shells, from the Eocene at Claiborne, Alabama: Am. Jour. Sci., ser. 1, vol. 40, p. 103, pl. 1, fig. 23.

1860 *Mitra claibornensis* Conrad, T. A., Descriptions of new species of Cretaceous and Eocene fossils of Mississippi and Alabama: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 4, pt. 3, pl. 47, fig. 6, figure only, no description.

1865 *Lapparia pactilis*, Conrad, T. A., Catalogue of the Eocene and Oligocene Testacea of the United States: Am. Jour. Conchology, vol. 1, no. 1, p. 24.

1890 *Mitra (Lapparia) pactilis* + *Mitra dubia*, De Gregorio, A., Monographie de la faune Éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 72–73, 75, pl. 5, figs. 39, 49, 56–60.

1893 *Turricula dubia*, in part, + *Mitra (Mitreola) pactilis*, Cossmann, M., Notes complémentaires sur la faune éocénique de l'Alabama: Annales de Géologie et de Paléontologie, livr. 12, p. 37, 38.

1937 *Lapparia pactilis*, Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 385–386, pl. 62, figs. 4, 6, 7, pl. 89, fig. 4.

1940 Stenzel, H. B., & Turner, F. E., The gastropod genera Cryptochorda and Lapparia in the Eocene of the Gulf Coastal Plain: Univ. Texas Pub. 3945, p. 816–819, pl. 45, figs. 3, 5.

Original Description: Subfusiform, with seven volutions, a single row of nodes on each except the two from the apex, which are smooth; apex papillated; spire elevated; columella with four folds; aperture nearly half the length of the shell.

Revised Description (Stenzel & Turner 1940): Shell heavy, slender; apical angle 38° to 45°; spire one-half the length of the shell. Protoconch ovoid in outline, large, consists of 2½ whorls which are worn or etched in all specimens at hand. Nepionic spire whorls with numerous weak retractive axial ribs which develop obscure nodes and become obscurely shouldered. The nodes may gradually disappear or remain to the last whorl and the axial ribs disappear gradually. Spire whorls with a slight subsutural collar and very steeply sloping slightly concave, nodose shoulder which is placed near the anterior suture; nodes generally 15 per whorl, obscure, and elongate in the direction of the growth lines; a few obsolete spiral threads occur on the subsutural collar; spire profile straight-sided. Body whorl ovoid with a very steeply sloping shoulder which is ill-defined if the specimen has no nodes on the body whorl or obscurely defined if it has; spirals missing in most specimens but some have a few obsolete threads on the obscure subsutural collar; growth lines smooth and numerous. Aperture narrow, deeply emarginate at the base; outer lip slightly retractive, smooth within, and sharp-edged; deeply notched base of aperture extends into a short, twisted canal. Siphonal fasciole convex, wrinkled with growth lines, and spirally twisted. Columella bears 4 strong folds, which spiral all the way up in the shell; the 4 folds are arranged according to increasing strength and decreasing inclination, the most anterior fold being the weakest and steepest of the four. Parietal wash thin; the parietal wall is slightly resorbed at the aperture.

Dimensions (Stenzel & Turner 1940): Figured topotype (pl. 45, fig. 3), length 33 mm., width 13 mm.; figured topotype (pl. 45, fig. 5), length 30 mm., width 12 mm.

Type Data: Five syntypes, No. 13576, in Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania. Figured topotypes (figs. 3, 5) in Stenzel collection, Austin, Texas.

ALABAMIENSIS WHITFIELD

TURRITELLA

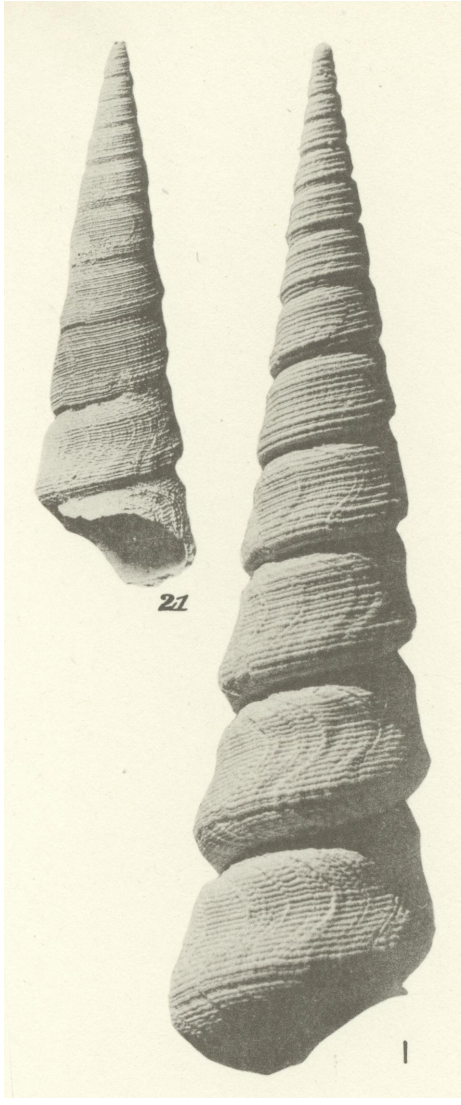


Fig. 21—syntype, X 2, refigured by Bowles 1939.

Fig. 1—topotype, X 3.

Type Data: Ten syntypes, Pal. Col. No. 24522, James Hall collection, Walker Museum, Univ. of Chicago, Chicago, Illinois.

Synonymy:

1865 *Turritella alabamiensis* Whitfield, R. P., Descriptions of new species of Eocene fossils: Am. Jour. Conchology, vol. 1, p. 267.

1894 Aldrich, T. H., The (Midway) Clayton Tertiary section and its fossils, *in* Report on the Geology of the Coastal Plain of Alabama: Alabama Geol. Survey, p. 246, pl. 13, fig. 2.

1896 Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 223, pl. 21, fig. 6.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 299, 300, pl. 32, fig. 21.

Original Description: Shell slender; volutions twelve or more; subquadrangular, lower margin sometimes projecting; suture distinctly marked; aperture sub-elliptical, slightly oblique; surface marked by numerous fine revolving lines, which are scarcely alternate, and crossed by distinct lines of growth, which make a deep sinus on the body of the volution, and are again bent backwards on the lower angle.

This species scarcely differs from *T. caelata*, Conrad, from the Vicksburg (Miss.) beds, except that it is destitute of the lines of granulas which give so decided a character to that species.

Observations: Apical whorls marked by 3 subequal inconspicuous lirae; finer threads introduced on third and fourth whorls gradually increase in size until on the later whorls they are the same size as the primary lirae. Whorls slightly concave in the middle, rounded and slightly expanded at the base; growth lines strongly marked and deeply flexed just posterior to the middle of the whorl. Differs from *T. aldrichi* Bowles in the lack of a subsutural collar and the protrusion of the base of the whorls. Specimens from the Sucarnoochee formation of Alabama have slightly stronger spirals at margin and base of anterior angulation.

Type Locality: Probably Matthews Landing, small bluff above abandoned landing on left bank of Alabama River west-northwest of Camden, north ½ sec. 12, T. 12 N., R. 6 E., Wilcox County, Alabama. Mistakenly given as 9 miles below Prairie Bluff, Alabama, by Whitfield (compare Aldrich, T. H., Notes on Tertiary fossils, with descriptions of new species: Cincinnati Soc. Nat. History Jour., vol. 10, p. 79, 1887).

Geologic Horizon: Naheola formation, Midway group, Paleocene.

Distribution: Midway group of Alabama, abundant in Naheola formation. Reported also from Texas.

ALDRICHI BOWLES

TURRITELLA

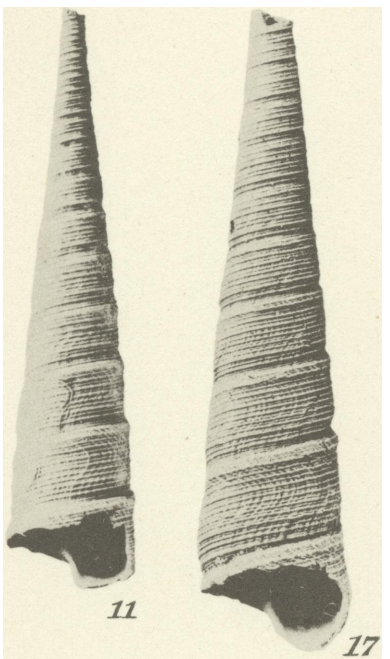


Fig. 11—holotype, X 2,
Fig. 17—paratype, X 2; Bowles 1939.

Type Data: Holotype, No. 495148, and paratype, No. 495149, U. S. Nat. Mus., Washington, D.C.

Type Locality: Matthews Landing, small bluff above the abandoned landing on Alabama River west-northwest of Camden, north ½ sec. 12, T. 12 N., R. 6 E., Wilcox County, Alabama.

Geologic Horizon: Naheola formation, Midway group, Paleocene, Alabama.

Distribution: Naheola and Clayton formations of Alabama and undifferentiated Midway of Georgia.

Synonymy:

1894 *Turritella humerosa* var. + *T. humerosa* var. *multilira*, Aldrich, T. H., The (Midway) Clayton Tertiary section and its fossils, *in* Report on the Geology of the Coastal Plain of Alabama: Alabama Geol. Survey, p. 239, 246, pl. 13, figs. 3, 5.

1896 *Turritella humerosa* + *humerosa* var. *multilira*, Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 224, 225, pl. 21, figs. 10, 11. Not *T. humerosa* Conrad 1835, nor *T. multilira* Whitfield 1865.

1939 *Turritella aldrichi* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, no. 3, p. 315, 316, pl. 34, figs. 11, 17.

Original Description: Spire high, acute, gently tapering. Whorls straight-sided, marked by a slight thickening just below the sutures, which are narrow but distinctly and deeply impressed. Sculpture of apical whorls consisting of three strong, evenly-spaced revolving lirae, the strongest anterior, the distance between the anterior lira and the suture approximately equal to that between the two lirae, the posterior cord, however, being relatively much closer to the posterior suture. Subsutural collar not pronounced on the extreme apical whorls, gradually becoming stronger with the growth of the shell; strength of the collar variable, in extreme and members being practically absent. Adult sculpture variable in character, usually consisting of numerous very fine, subequal revolving cords, but occasionally with four or five of the cords relatively more prominent, the three apical cords stronger than those of later origin. Incrementals reflexed as in other members of the *Turritella humerosa* group, but more strongly marked than in typical *T. humerosa;* commonly cutting the subsutural collar so as to give it a crenulated or beaded appearance and also slightly beading the spiral lirae at their intersections with the incrementals. No perfect aperture observed.

Dimensions: Holotype, height, 39.0 mm; greatest diameter, 9.0 mm. Paratype, height, 41.0 mm; greatest diameter, 10.0 mm. (Both the holotype and the paratype are broken at the aperture and apex.)

Observations (Bowles 1939): Turritella aldrichi differs from the lower Midway form, *T. claytonensis,* in its coarser sculpture, the persistence of the three distinct ribs on the apical whorls, and in the less pronounced subsutural collar. From *T. biboraensis* of the lower Midway of Texas, it differs in its less distinct subsutural collar, its relatively smaller size, and the coarseness of the revolving striae on the adult whorls. Unfortunately the apical sculpture of the Texas form is unknown.

It is difficult to distinguish some of the specimens of *Turritella aldrichi* from some specimens of the contemporaneous *T. alabamiensis* Whitfield. The two species represent different groups, *T. alabamiensis* being a fore-runner of the prominent *T. mortoni* group of the Wilcox, while *T. aldrichi* apparently is closely related to the Wilcox *T. humerosa.* When the subsutural collar of *T. aldrichi,* however, is not particularly prominent, the specimens closely resemble individuals of *T. alabamiensis* in which the basal carina is indistinct. The two forms have been separated taxonomically because of their apparent relationships to the later well-established and distinct groups of *T. mortoni* and *T. humerosa.*

Turritella aldrichi is the only representative of the *T. humerosa* stock found in the upper Midway of the Eastern Gulf province. Miss Gardner (1935, pp. 288–290) recorded molds and badly weathered fragments of the specifically indeterminate *Turritella* allied to the *T. humerosa* group, from the Wills Point formation of Texas.

ALVEATA CONRAD

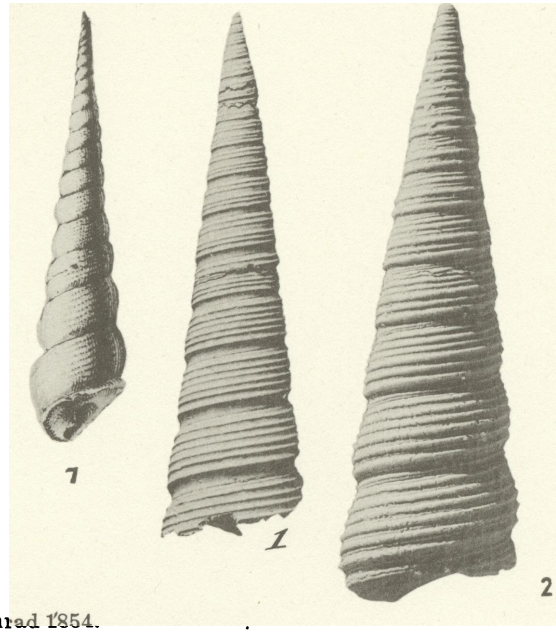


Fig. 7—Conrad 1854.
Fig. 1—topotype, X 2, Bowles 1939.
Fig. 2—topotype, X 3.

Type Data: Lectotype and a paratype, No. 13213, Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania.

Type Locality: Moodys Branch, cliff on right bank of branch near intersection of Peachtree Street and Poplar Boulevard in northern part of Jackson, Hinds County, Mississippi.

Geologic Horizon: Moodys marl, Jackson group, upper Eocene.

Distribution: Moodys marl, Jackson group, upper Eocene, of Mississippi and Louisiana. Reported by Bowles 1939 from Moodys marl of Bradley County, Arkansas.

Synonymy:

1854 *Turritella alveata* Conrad, T. A., *in* Wailes, B. L. C., Report on the Agriculture and Geology of Mississippi, pl. 17, fig. 7.

1855 Conrad, T. A., Observations on the Eocene deposit of Jackson, Miss., with descriptions of thirty-four new species of shells and corals: Acad. Nat. Sci. Philadelphia Proc., vol. 7, p. 263.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 306, 307, pl. 32, fig. 1.

Original Description (Conrad 1855): Elongated; whorls about nineteen; revolving lines prominent, about six in number alternated with a minute line; volutions excavated at base and minutely striated.

Allied to *T. obruta*, Con., (*T. lineata*, Lea,) of Claiborne, but greatly more elongated.

Observations: Apical whorls marked by three equidistant subequal revolving lirae, placed symmetrically on the whorl; a fourth lira arising on the sixth whorl posterior to the three primaries, a fifth appearing on the seventh whorl in the middle of these 4 ribs; secondary lines rapidly becoming more prominent until on the adult whorls they are equal in size to the primaries and indistinguishable from them. Adult whorls marked by 5 to 7 equidistant subequal revolving lirae, separated from the anterior by a wide channelled smooth area without spiral sculpture. Incrementals distinct but not prominent, deeply arcuate with the maximum flexure attained a little behind the median of the whorl, very slightly reflexed just behind the anterior suture.

Specimens from Garland's Creek show the fourth, fifth, and sixth ribs appearing two to four whorls later in development, slightly more slender coiling of early whorls, a tendency for the middle spiral to be strongest giving the whorls a profile protruding at that point rather than flat-sided as on Moodys Branch specimens.

Turritella alveata differs from *T. perdita* Conrad of the Jackson, with which it is associated in many collections, by the much smaller apical angle, less angulated and more evenly sculptured whorls and the much less deeply impressed sutures.

APITA DE GREGORIO

TURRITELLA

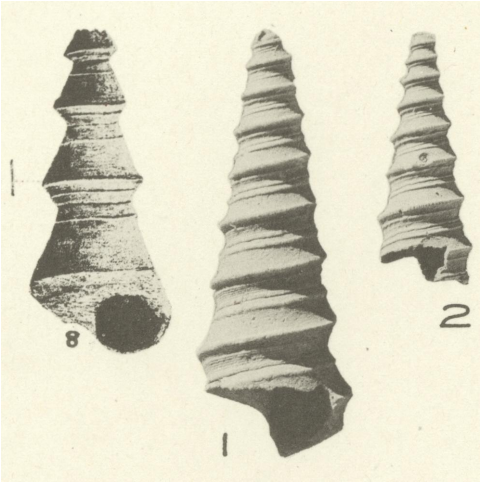


Fig. 8—De Gregorio 1890.
Figs. 1, 2—topotypes, X 3.

Type Data: Holotype in De Gregorio home, Via Molo 132, Palermo, Sicily. Lectotype of *T. carinata* H. C. Lea, No. 13173, Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania. Topotypes figured above, Stenzel collection, Austin, Texas.

Type Locality: Claiborne Bluff on left bank of Alabama River, Monroe County, Alabama.

Geologic Horizon: Gosport sand, Claiborne group, middle Eocene.

Distribution: Gosport sand of Alabama.

Synonymy:

1840 *Turritella carinata* Lea, H. C., Description of some new species of fossil shells from the Eocene, at Claiborne, Alabama: Am. Jour. Sci., ser. 1, vol. 40, p. 96–97, pl. 1, fig. 10. Not *T. carinata* Isaac Lea 1833.

1887 Meyer, Otto, On invertebrates from the Eocene of Mississippi and Alabama: Acad. Nat. Sci. Philadelphia, Proc. for 1887, p. 54, pl. 3, figs. 1, 1a.

1890 *Turritella apita* de Gregorio, A., Monographie de la faune éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 123, pl. 11, figs. 8, 26, 27.

1937 Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 195, 197, pl. 24, figs. 1, 3, 7, 10.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 275, pl. 31, fig. 4.

Original Description (translated): Test minute, elegant, turrited, cylindrical; whorls subconical, rather broad, anteriorly angulate-carinate; between the carina and anterior suture ornamented by another spiral thread.

Observations: Shell small; apical angle 20°; a single strong median carina on apical whorls; a minor accessory lira appears anterior to the carina on the second or third whorl and becomes more prominent on the adult whorls; a second accessory lira develops at posterior suture, moves gradually with age away from that suture, and becomes as prominent as the other accessory lira; numerous fine revolving threads present on entire surface of whorl, slightly larger threads between anterior suture and adjoining accessory lira, nearly obsolete threads on posterior slope of carina; this slope is nearly smooth; whorl shape remains unicarinate throughout; incrementals produce beading on carina occasionally.

This species is very well defined, but not abundant. It is one of the two *Turritella* species from the older Tertiary of the Gulf coast which have unicarinate apical whorls. The other species is *T. arenicola* (Conrad), a species which is distinguished by its greater size and rounded multistriate adult whorls.

ARENICOLA (CONRAD)

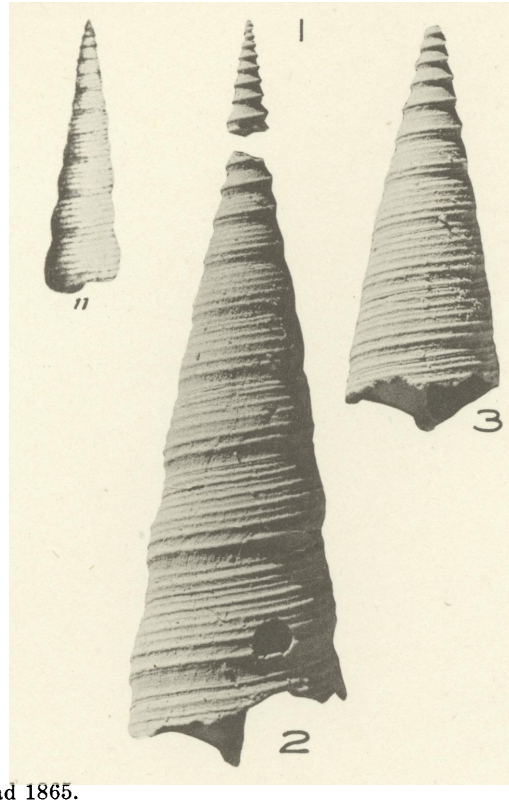


Fig. 11—Conrad 1865.
Figs. 1, 2, 3—topotypes, X 3.

Type Data: Holotype lost, lectotype and two paratypes in Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania.

Type Locality: Garlands Creek, bluff on south bank of creek, 0.2 mile east of the bridge and about 3.5 miles northeast of Shubuta (airline distance), northeast corner of sec. 28, T. 1 N., R. 16 E., Clarke County, Mississippi. Mistakenly given as Enterprise, Mississippi, by Conrad (Aldrich, T. H., Observations on the Tertiary of Alabama: Am. Jour. Sci., ser. 3, vol. 30, p. 307, 1885).

Geologic Horizon: Moodys marl, Jackson group, upper Eocene.

Distribution: Moodys marl of Mississippi, Louisiana, Arkansas, Texas, and Mexico, and in the top part of Creola member of Yegua formation on right bank of Sabine River, 3,000 feet down-stream from Robinson's Ferry, Sabine County, Texas; compare Stenzel, H. B., The Yegua problem: Univ. Texas Pub. 3945, p. 872, 1940.

Synonymy:

1865 *Mesalia? arenicola* Conrad, T. A., Descriptions of new Eocene shells from Enterprise, Mississippi: Am. Jour. Conchology, vol. 1, p. 141, pl. 10, fig. 11.

1939 *Turritella arenicola,* in part, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 275–277, pl. 31, fig. 7. Not figs. 5, 6 = *T. arenicola* var. *branneri* Harris.

Original Description: Volutions thirteen? convex, penultimate, and two contiguous volutions, each with seven acute, prominent, revolving lines; the two inferior lines remote, and the third more prominent and distant than the remainder; towards the apex this line is not more prominent than those above it, but the second becomes large and carinates the volutions, giving them an angular appearance; one, and occasionally two, very fine lines alternate with the others.

Observations: Apical angle 18° juvenile, 25° in the last part of the juvenile stage, 14° adult; shell profile concave in juvenile stage, convex at the transition from juvenile to adult. Apical whorls have a single prominent carina a little anterior to the median of the whorl, secondary lira appears anterior to primary carina on sixth whorl or later, followed on next whorl by a less prominent lira just anterior to suture; primary carina becomes less prominent while the two secondary lira increase in size and 2 additional lirae arise between the primary and the posterior secondary lira; 4 or 5 smaller accessory lirae are intercalated later, but usually remain slightly smaller than the other lirae. A smooth slightly excavated area marked only with very fine threads exists between the anterior suture and the anterior secondary lira. Incrementals most advanced at posterior suture, less so at anterior suture, to which they descend at a steep angle; the deep sinus centers posterior to the primary lira. Whorls straight-sided or slightly convex; convexity increasing with age.

This common species is readily distinguished from other species but grades into *T. arenicola* var. *branneri* Harris and *T. arenicola danvillensis* Stenzel & Turner. The var. *branneri* has fewer revolving ribs in the adult stage. The subspecies *danvillensis* has more sharply raised revolving ribs and more convex whorls.

Prepared by H. B. Stenzel & F. E. Turner, Bureau of Economic Geology, Austin, Texas.

BELLIFERA ALDRICH

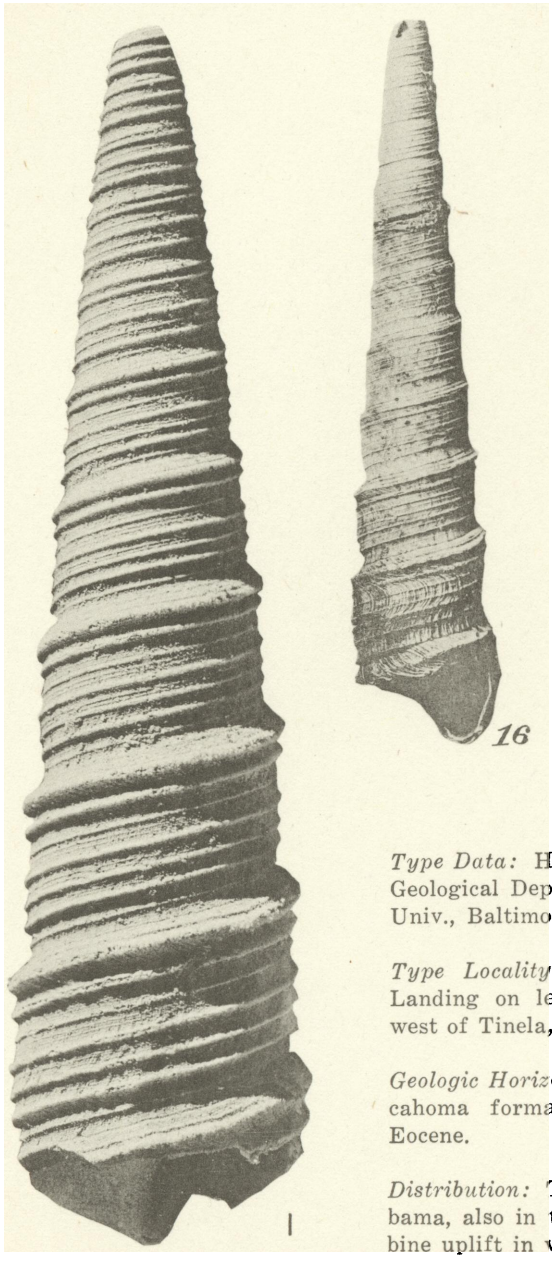


Fig. 16—holotype refigured by Bowles 1939, X 1.
Fig. 1—topotype, X 3.

Type Data: Holotype in Aldrich collection, Geological Department, The Johns Hopkins Univ., Baltimore, Maryland.

Type Locality: Lower stratum at Bells Landing on left bank of Alabama River west of Tinela, Monroe County, Alabama.

Geologic Horizon: Bells Landing beds, Tuscahoma formation, Wilcox group, lower Eocene.

Distribution: Tuscahoma formation of Alabama, also in the Wilcox group of the Sabine uplift in western Louisiana.

Synonymy:

1885 *Turritella bellifera* Aldrich, T. H., Notes on the Tertiary of Alabama and Mississippi, with descriptions of new species: Cincinnati Soc. Nat. History Jour., vol. 8, p. 150, pl. 3, fig. 13.

1886 Aldrich, T. H., Preliminary report on the Tertiary fossils of Alabama and Mississippi: Alabama Geol. Survey, Bull. 1, p. 34, pl. 1, fig. 13.

1890 *Turritella (Proto) cathedralis bellifera*, de Gregorio, A., Monographie de la faune éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 127, pl. 11, figs. 17, 38.

1899 *Turritella humerosa*, Harris, G. D., Preliminary report on the Geology of Louisiana: Louisiana Geol. Survey, Rept. for 1899, p. 308, pl. 55, fig. 5.

1939 *Turritella bellifera*, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 317, 318, pl. 34, fig. 16.

Original Description: Shell turrited, subulate; whorls over fourteen; surface with numerous, prominent, revolving striae, inequidistant, with a number of very fine lines between; lines of growth indistinct on the upper whorls, increasing toward the aperture; on the last whorl, and sometimes the one next above becoming plicate and leaflike; lines wavy, bent toward the sutures; mouth rotund, oval, longest axis with the shell; shell contracted at the suture; suture indistinct; whorls shouldered on the upper part, bounded by a raised line which is itself divided in some specimens. Columella with a smooth callus spreading out in a semi-circle beyond the aperture. Length of part remaining, 3 8/10 inches; breadth, 7/10.

Observations: Differs from *T. humerosa* Conrad of the Aquia formation by its coarser sculpture and more angular subsutural carina. In *T. humerosa* the carina is formed by a thickening of the whorl just anterior to the suture, and the spiral sculpture continues unchanged over this thickened portion. In *T. bellifera* the posterior primary lira gradually increases in size until it distinctly carinates the whorl.

Turritella multilira Whitfield from the underlying Nanafalia formation differs in its finer and more numerous revolving striae.

BIBORAENSIS GARDNER

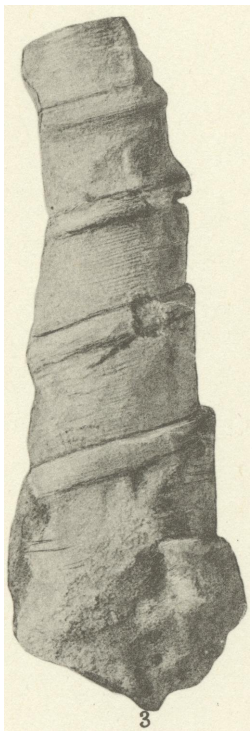


Fig. 3—holotype, X 2, Gardner 1935.

Type Data: Holotype No. 370989, U. S. Nat. Mus., Washington, D.C.

Type Locality: Bibora (or Rattlesnake) tank on the headwaters of a left tributary of Cuevas Creek, 6½ miles airline distance above the mouth of Cuevas Creek, on the Indio ranch, on east side of the old Eagle Pass-Laredo road, 18 miles southeast of Eagle Pass, Maverick County, Texas.

Geologic Horizon: Lower part of Kincaid formation, Midway group, Paleocene.

Distribution: Kincaid formation, central and south Texas.

Synonymy:

1935 *Turritella biboraensis* + *T.* cf. *humerosa* Gardner, J. A., The Midwey group of Texas: Univ. Texas Bull. 3301, p. 289–291, pl. 25, figs. 2, 3.

1939 *Turritella humerosa biboraensis,* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 313, 314.

Original Description (abbreviated): Well characterized by the very slowly tapering spire, the broad whorls, the strong rounded collar directly in front of the suture, and the fine, even, and evenly spaced spiral sculpture which covers the entire whorl.

Dimensions.—Height of broken individual, 42.4 millimeters; greatest diameter, 15.9 millimeters.

Observations: Whorls straight-sided below sutural collar. The species is smaller and more delicately sculptured than *T. humerosa* Conrad. *Turritella multilira* Whitfield has more rapidly increasing whorls and is without prominent swelling in front of the suture. Gardner 1935 has also made comparisons with South American species.

BOWENAE MANSFIELD

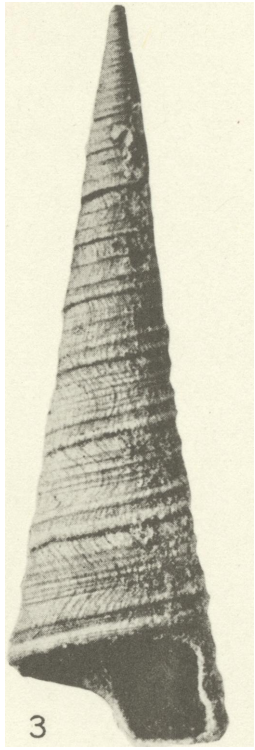


Fig. 3—holotype, X 1½, Mansfield 1937.

Type Data: Holotype No. 495956, U. S. Nat. Mus., Washington, D.C.

Type Locality: Blackwater Creek at Seaboard Air Line Railway crossing, Hillsborough County, Florida. Probably from the lower part of the section.

Geologic Horizon: Suwanee limestone, upper Oligocene.

Distribution: Suwanee limestone of Hernando and Pasco counties, western Florida.

Synonymy:

1937 *Turritella bowenae* Mansfield, W. C., Mollusks of the Tampa and Suwanee limestones of Florida: State of Florida, Dept. Conservation, Geol. Bull. 15, p. 166–167, pl. 9, fig. 3.

Original Description: Shell of moderate size, rather stout, consisting of about 15 whorls; nucleus decollate. Whorls nearly straight; suture lowly depressed. Sculpture of penultimate whorl, beginning at the base, consisting of two equal sized primary spirals about 1 mm. apart, the lower one marginating the suture; a smaller spiral at the upper third and two small spirals above and below this spiral. Primary and secondary spirals and interspaces are overrun by tertiary spiral threadlets. The narrow area below the suture is marked only with tertiary threadlets. A very low depression is behind the lower pair of primaries. In ascending the whorl, two spirals, one at the upper third and the other at the lower third of the whorl persist with a shallow depression between them.

Holotype measures: Height, 60 mm.; greatest diameter, 19 mm.

Observations (Mansfield 1937): This species differs from *Turritella tampae* in having a narrower and shallower equatorial constriction which is ornamented with much finer spirals. *Turritella tripartita* Dall has a much weaker spiral above the basal one and a more concave equatorial area. The new species is closely related to *T. halensis* Dall from Hale Landing, Flint River, differing from the latter in having a less depressed equatorial area.

ARENICOLA BRANNERI HARRIS

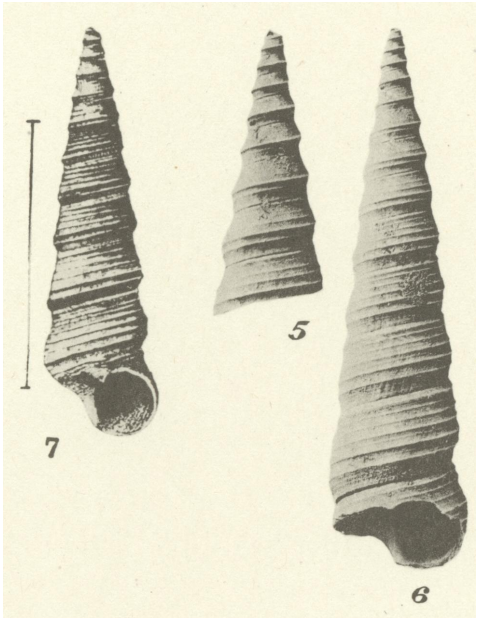


Fig. 7—holotype, Harris 1894.
Fig. 5—topotype, X 3,
Fig. 6—same topotype, X 2; Bowles 1939.

Type Data: Holotype No. 135141, U. S. Nat. Mus., Washington, D.C.

Type Locality: White Bluff on right bank of Arkansas River, western part of secs. 19 and 30, T. 3 S., R. 10 W., Jefferson County, Arkansas.

Geologic Horizon: Jackson group, upper Eocene.

Distribution: Jackson group of Arkansas.

Synonymy:

1894 *Turritella arenicola branneri* Harris, G. D., The Tertiary geology of southern Arkansas: Arkansas Geol. Survey, Ann. Rept. for 1892, p. 169, pl. 6, fig. 7.

1937 Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 197, pl. 23, figs. 1, 2.

1939 *Turritella arenicola*, in part, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 275, pl. 31, figs. 5, 6.

Original Description: This variety differs from true *arenicola* in having fewer revolving lines, less rounded whorls, and in being of considerably smaller size.

Observations: We have not had access to material belonging to this subspecies. Therefore, we do not know whether it is valid and how it compares with *T. arenicola danvillensis* Stenzel & Turner other than by illustrations which indicate that *danvillensis* has higher and sharper ribs, broader adult apical angle and broader whorls.

NASUTA BRAZITA STENZEL & TURNER

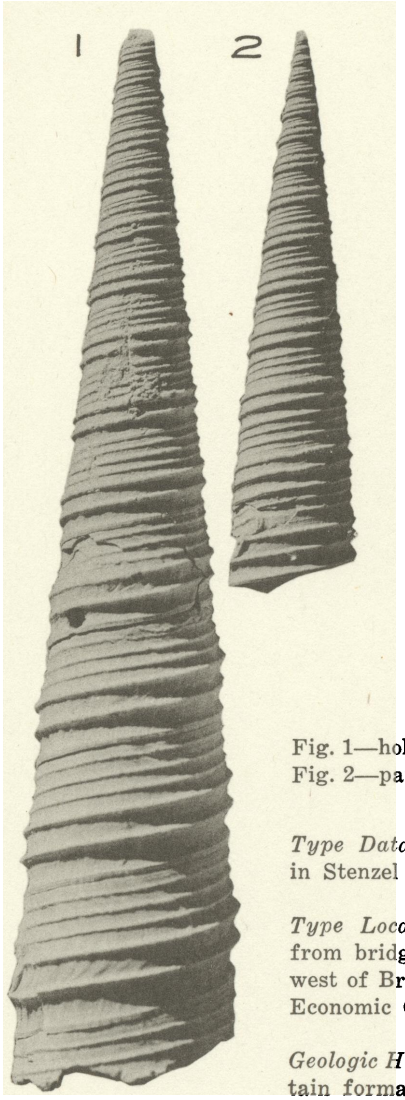


Fig. 1—holotype, X 3,
Fig. 2—paratype, X 3.

Type Data: Holotype and numerous paratypes in Stenzel collection, Austin, Texas.

Type Locality: Little Brazos River, upstream from bridge of State highway No. 21, 9.4 miles west of Bryan, Brazos County, Texas; Bureau of Economic Geology locality No. 21–T–1.

Geologic Horizon: Wheelock member, Cook Mountain formation, Claiborne group, middle Eocene.

Distribution: Cook Mountain formation of central and east Texas.

Synonymy:

1940 *Turritella nasuta brazita* Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 835, pl. 46, figs. 1, 2.

Original Description: Apical angle, juvenile 14°–17°, adult 10°–12°; shell long, slender; spire profile very slightly convex. Adolescent whorls trilirate, the 2 anterior lirae slightly stronger and remaining so throughout the shell. Adult whorls usually with 4–5 sharp spiral ribs, the fourth rib appearing near the suture posterior to the 3 primary ribs; occasionally a fifth and even sixth secondary are added between the primary ribs. Many fine striae between the ribs. Whorls vary in shape from straight-sided to slightly convex; greatest diameter at the anterior primary rib. Growth lines sinuous with maximum inflection slightly posterior to middle primary rib. Base of body whorl sharply set off from the sides by a flange. On the spire this flange is hidden by the suture.

Turritella nasuta brazita resembles *T. dutexata* Harris and *T. femina oligoploka* Stenzel in the adult ribbing; it is distinguished from *T. dutexata* by the trilirate adolescent whorls, the greater number of ribs on adult whorls, and lesser convexity of its whorl shape; it is distinguished from *T. femina oligoploka* by the greater number of ribs on the adult whorls, the lesser convexity of its whorl shape, and the more sharply raised spiral ribs. It differs from typical *T. nasuta* Gabb in the much greater strength of ribbing, particularly of the two anterior primaries.

Prepared by H. B. Stenzel & F. E. Turner, Bureau of Economic Geology, Austin, Texas.

CAELATURA CONRAD

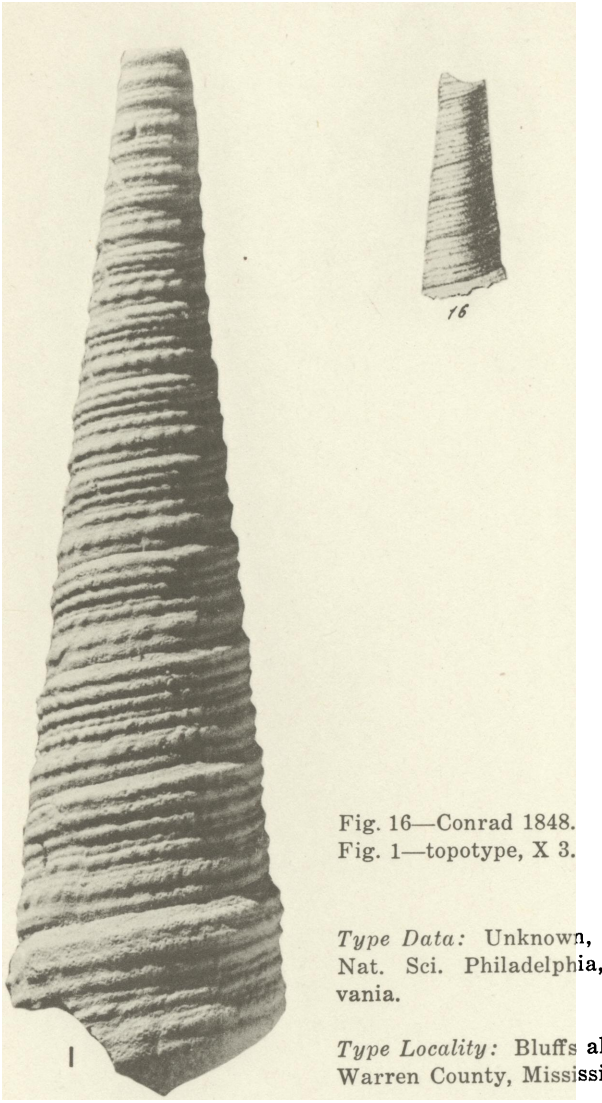


Fig. 16—Conrad 1848.
Fig. 1—topotype, X 3.

Type Data: Unknown, presumably in the Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania.

Type Locality: Bluffs along creeks in Vicksburg, Warren County, Mississippi.

Geologic Horizon: Mint Spring marl, Vicksburg group, Oligocene.

Distribution: Mint Spring marl of Mississippi.

Synonymy:

1848 *Turritella caelatura* Conrad, T. A., Observations on the Eocene formation, and descriptions of one hundred and five new fossils of that period, from the vicinity of Vicksburg, Mississippi; with an Appendix: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 1, pt. 2, p. 114, pl. 14, fig. 16.

Original Description: Slightly turreted; whorls flattened, with crenulated or beaded revolving lines, about five to each volution; lines of growth sinuous, and apparently forming the crenulating character of the striae; suture profound.

Revised Description: Apical angle of first 6 whorls 22°, sixth to sixteenth whorls 9°, adult portion 14°. Between the embryonic and adolescent portions of the shell the spire profile is convex, between the adolescent and adult portions it is concave. So far as can be determined the nuclear whorls are smooth with very faint threads appearing on the sixth or seventh whorl; at the seventh or eighth whorl the whorls change from convex to concave with a posterior primary rib marking the posterior edge of the excavated belt. The anterior edge of the excavated belt is marked by the first rib posterior to the basal angulation. This rib is occasionally equal in strength to the posterior primary. One secondary spiral develops behind the posterior primary and up to six unequal spirals may develop in the excavated belt. All spirals are noded. The excavated belt occupies the mid-half of the whorl. Adult whorls usually have about 8 major noded spirals.

In spire and whorl profile and beaded spirals this species resembles *T. perdita* Conrad. It is distinguished from that species by the smoothness and lack of trilirate ribbing on the early whorls and slightly heavier noding of the ribs.

Prepared by H. B. Stenzel & F. E. Turner, Bureau of Economic Geology, Austin, Texas.

CARINATA LEA

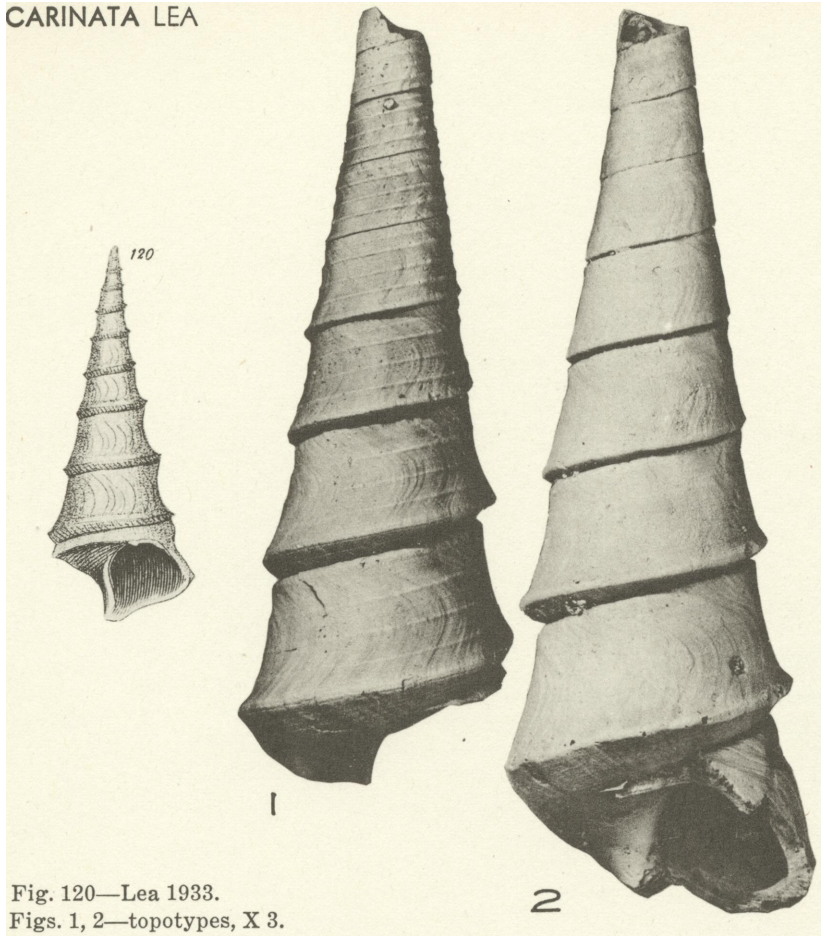


Fig. 120—Lea 1933.
Figs. 1, 2—topotypes, X 3.

Type Data: Holotype No. 5661 and 6 paratypes Nos. 5662–5667 in Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania. Figured topotypes, Stenzel collection, Austin, Texas.

Type Locality: Claiborne Bluff on left bank of Alabama River, Monroe County, Alabama.

Geologic Horizon: Gosport sand, Claiborne group, middle Eocene.

Distribution: Gosport sand of Alabama and in top part of Creola member of Yegua formation on right bank of Sabine River, 3,000 feet downstream from Robinson's Ferry, Sabine County, Texas; compare Stenzel, H. B., The Yegua problem: Univ. Texas Pub. 3945, p. 872, 1939. *Turritella carinata* Lea s.s.—without the variants towards *T. ghigna* De Gregorio—is present in eastern Mississippi in the Wautubbee formation, Claiborne group, middle Eocene.

TURRITELLA

Synonymy:

1833 *Turritella carinata* Lea, Isaac, Contributions to Geology, Philadelphia, p. 129, 130, pl. 4, fig. 120. Not (*T. carinata* H. C. Lea 1840) = *T. apita* De Gregorio 1890.

1835 *T. mortoni* var. *A.* Conrad, T. A., Fossil shells of the Tertiary formations of North America [republication], p. 40, pl. 15, fig. 11. Not *T. mortoni* Conrad 1830.

1840 *T. monilifera* + *gracilis* Lea, H. C., Description of some new species of fossil shells, from the Eocene, at Claiborne, Alabama: Am. Jour. Sci., vol. 40, p. 97, pl. 1, fig. 11, 12. Not *T. monilifera* G. P. Deshayes 1832.

1890 *T. carinata* + *litripa* + *enterina* +*gracilis* de Gregorio, A., Monographie de la faune éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 122, 125, 126, 127, pl. 11, figs. 3–6, 9, 20, 32, 34–36.

1937 *T. carinata,* Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 189, pl. 24, figs. 5, 6, 8, 9, 12, pl. 82, fig. 1.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 304, 305, pl. 33, fig. 13.

Original Description: Shell turrited, transversely striate and carinate; apex acute; substance of the shell thick; suture impressed; whorls concave, carinate on the inferior part; mouth suborbicular, effuse.

Observations: Whorls numerous, wider than high, straight-sided in youth, becoming slightly concave and strongly carinate basally when adult. Sutures narrow, deeply impressed, particularly between the adult whorls. Apical whorls marked by two, later three equal indistinct spiral lirae, placed symmetrically on the whorl; accessory spiral lirae added with the growth of the shell, their number and strength and position on the whorls varying greatly; spiral developing anterior to the three primary lirae forming a marked basal carina on the adult whorls; base of body whorl sculptured by a few indistinct revolving threads. Incrementals distinct but not prominent, strongly arcuate, attaining the maximum of their curvature a little behind the median of the whorl. *Turritella carinata* is an exceedingly variable species. Lea's holotype is a typical adult with the basal carina well developed. Extreme individuals have straight-sided whorls with little indication of a basal carina. Revolving lirae on some specimens distinctly beaded. Adult whorls show two to six revolving lirae. Palmer 1937, p. 191, used the name *T. ghigna* De Gregorio 1890 for extreme individuals in which the apical angle is greater, the early and adult whorls more prominently ribbed and in which the basal carina is either much reduced or absent. The same usage is followed here, although Bowles 1939 included *T. ghigna* under the synonymy of *T. carinata,* recognizing that *T. ghigna* is merely an end member in a continuous series of variants without stratigraphic significance.

The nearest relative of *T. carinata* is *T. carinata palmerae* Bowles. The latter differs from the typical form in its more constant and more rounded basal carina and much more distinct sculpture. These differences are recognized because of the lower stratigraphic position of the subspecies.

RINA CAROLINA PALMER

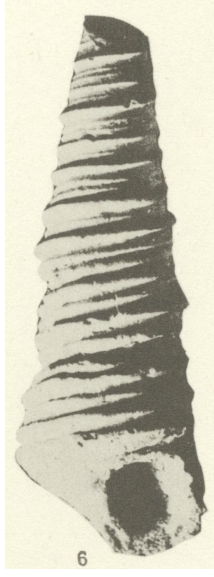


Fig. 6—holotype, X 7/5, Palmer 1937.

Type Data: Holotype No. 2872, Paleontological Research Institution, Ithaca, New York.

Type Locality: About 3 miles west-northwest of Orangeburg, Orangeburg County, South Carolina.

Geologic Horizon: McBean formation, Claiborne group, middle Eocene.

Distribution: Known only from type locality.

Synonymy:

1937 *Turritella rina carolina* Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 32, p. 194, pl. 22, fig. 6.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 280.

Original Description: Shell large, strongly sculptured; nepionic whorls unknown; immature whorls bicarinated with the lower carina the larger; at the same stage of development there is a fine, spiral rib just below the suture, one between the two primary ribs and one just above the suture; in maturity, the suture becomes excavated, the fine, spiral ribs enumerated increase in size until there are five large revolving ribs on the penultimate and body whorls; original carina slightly larger than the intermediate ribs; only fine spiral threads occur below the basal carina on the body whorl.

Dimensions.—Height, 50 mm (incomplete); greatest diameter, 16 mm; apical angle, 15°, holotype.

Observations: This subspecies has the same basic pattern of ornamentation as the near related *T. rina* Palmer, *T. rina subrina* Palmer, and *T. cortezi* Bowles. It differs from these three by the presence of the strong medial rib.

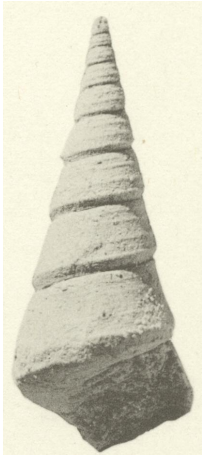


Fig. 3—holotype, X 3.

Type Data: Holotype in Turner collection, Agricultural & Mechanical College of Texas, College Station, Texas.

Type Locality: East ditch of road from Chireno to State highway No. 21, north of town, Nacogdoches County, Texas.

Geologic Horizon: Cane River formation, Claiborne group, middle Eocene.

Distribution: Known only from type locality.

Synonymy:

1940 *Turritella chirena* Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 838, 839, pl. 47, fig. 3.

Original Description: Apical angle 25°; spire profile slightly concave. Apical whorls with three primary spiral lirae which gradually become obsolete on adult whorls; one obsolete accessory spiral is added between the posterior primary rib and the suture. Whorls obtusely angulated near the anterior suture, making the sutures appear impressed. Whorls straight or slightly concave between the angulation and the posterior suture. Base of body whorl smooth with a slight angulation at the place which the suture occupies. Growth lines sinuous with maximum inflection slightly posterior to the middle of the whorl and sharply inflected at the basal angulation.

This species is distinguished from *T. carinata* Lea by the greater apical angle of the early whorls and straighter spire profile. It differs from some specimens of *T. carinata* by the early obsolescence of the lirae and from other specimens of *T. carinata* by the lack of a sharp carina. *Turritella carinata palmerae* Bowles has stronger and more numerous spiral lines.

CLAYTONENSIS BOWLES

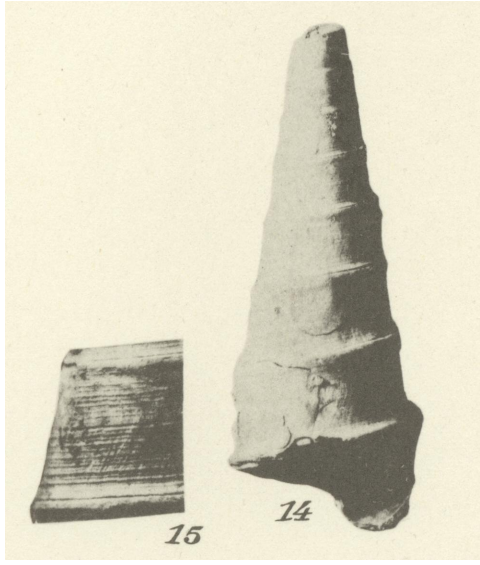


Fig. 14—holotype, X 1,
Fig. 15—holotype, X 3; Bowles 1939.

Type Data: Holotype No. 131637, U. S. Nat. Mus., Washington, D.C.

Type Locality: Prairie Creek, about 3 miles north of Oakhill, Wilcox County, Alabama.

Geologic Horizon: Clayton formation, Midway group, Paleocene.

Distribution: Clayton formation of Alabama.

Synonymy:

1896 *Turritella humerosa*, Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 224, pl. 21, fig. 12.

1939 *Turritella claytonensis* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 314, 315, pl. 34, figs. 14, 15.

Original Description: Spire high, more abruptly tapering than is customary in the *Turritella humerosa* group. Whorls flattened laterally and marked by a distinct subsutural collar, which encroaches slightly onto the preceding whorl, the suture being shallowly impressed on the upper surface of the collar. Both apical and adult whorls sculptured only by numerous very fine, distinct, subequal, evenly spaced revolving lines. Growth lines sharply and deeply curved at about the median of the whorl, and then reflexed, meeting the anterior suture just a little behind their intersection with the posterior suture. Aperture not preserved complete on any of the specimens observed.

Dimensions: Holotype, height, 68.0 mm; greatest diameter, 26.0 mm. The specimen is broken both at the aperture and the apex.

Observations (Bowles 1939): The very distinctive, fine, evenly spaced sculpture, the abrupt tapering of the spire, the large size, and the encroachment of each whorl over the preceding whorl differentiate *Turritella claytonensis* from typical *T. humerosa* and its southern Wilcox analogues. *Turritella aldrichi* of the Alabama Midway is also a smaller, more gradually tapering species.

The specimen figured by Harris in 1896 is the one selected for the holotype of *T. claytonensis*. Harris referred this form to *T. humerosa*.

CLEVELANDIA HARRIS

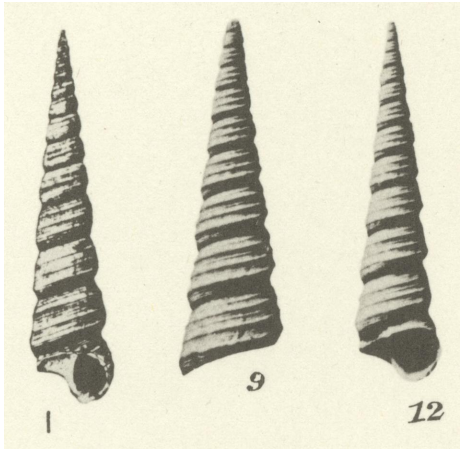


Fig. 1—X 2, Harris 1894.
Fig. 9—lectotype, X 3,
Fig. 12—same, X 2; Bowles 1939.

Type Data: Lectotype No. 498010 and syntype lot No. 135142, U. S. Nat Mus., Washington, D.C.

Type Locality: White Bluff on right bank of Arkansas River, in western part of secs. 19 and 30, T. 3 S., R. 10 W., Jefferson County, Arkansas.

Geologic Horizon: Jackson group, upper Eocene.

Distribution: Jackson group of Arkansas. Reported by Bowles 1939 from the Jackson group of Texas and Louisiana.

Synonymy:

1894 *Turritella clevelandia* Harris, G. D., The Tertiary geology of southern Arkansas: Arkansas Geol. Survey, Ann. Rept. for 1892, p. 170, pl. 6, fig. 9.

1937 Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 202, 203, pl. 26, figs. 6, 7.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 308, 309, pl. 31, figs. 9, 12.

Original Description: Specific characteristics: Size and general form as indicated by the figure; whorls 13 or 14; generally ornamented by about three prominent revolving lines and a few subordinate ones; from the uppermost and lowest of the revolving lines the whorls slope abruptly to the suture, while between these lines the sides of the whorls are straight.

Observations (Bowles 1939): Turritella clevelandia is one of the most abundant and most widespread of the Jackson Turritellas. The small size, very slender form and dominantly tripartite sculpture distinguish this species from its associates. The nearest analogous species seems to be *Turritella gilberti* of the upper Wilcox of Alabama, but the lower Eocene form may be readily distinguished by its less deeply incised sutures and more-inflated whorls. The material from Woods Bluff was first identified by Harris as *T. clevelandia*, but in 1899 he pointed out the differences between the two forms, not, however, naming the older species.

Turritella clevelandia is represented only in the central part of the Gulf province, from Louisiana through Arkansas and into East Texas. It has not been recorded from Mississippi or Alabama.

CORTEZI BOWLES

TURRITELLA

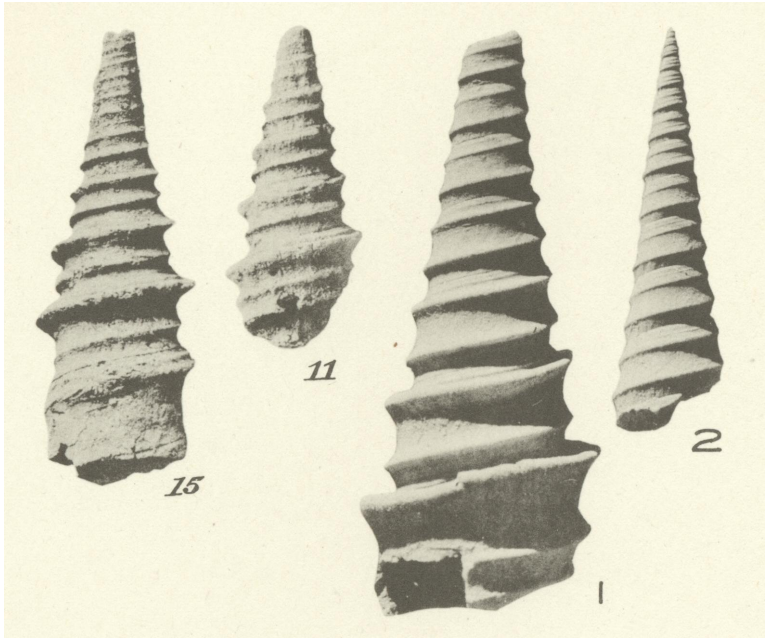


Fig. 11—paratype X 2,
Fig. 15—holotype X 2; Bowles 1939.
Figs. 1, 2—specimens, X 3, from locality 145–T–71, Leon County, Texas.

Type Data: Holotype No. 495172, paratype No. 495173, U. S. Nat. Mus., Washington, D.C.

Type Locality: South 44° west, 7,200 meters from the church tower in Mier, Tamaulipas, northeastern Mexico.

Geologic Horizon: Cook Mountain formation, Claiborne group, middle Eocene.

Distribution: A dependable key fossil in the Cook Mountain of southern Texas and northern Mexico from LaSalle County to 40 kilometers beyond the Mier structure, Tamaulipas, Mexico, according to Bowles 1939. The *Turritella cortezi* zone occurs about 385 feet below the top of the Cook Mountain formation in Webb County; the same zone occurs in Leon and Houston counties, Texas, about 315 feet below the top of the Cook Mountain formation, in the Hurricane lentil of the lower Landrum member (compare Stenzel 1939, p. 157, and Stenzel 1940).

Synonymy:

1939 *Turritella cortezi* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 280, 281, pl. 31, figs. 11, 15.

1939 *Turritella* n.sp. aff. *subrina* Stenzel, H. B., The Geology of Leon County, Texas: Univ. Texas Pub. 3818, p. 157, 158.

1940 *Turritella cortezi*, Stenzel, H. B., New zone in Cook Mountain formation, the *Crassatella texalta* Harris—*Turritella cortezi* Bowles zone: Am. Assoc. Petroleum Geologists Bull., vol. 24, no. 9, p. 1663–1675, text fig. 2.

Original Description: Shell fairly small, robust. Spire rather abruptly tapering. Whorls equidimensional and straight-sided in youth, wider than high and strongly carinate when adult. Apical whorls decorated with two prominent subequal revolving lirae, the posterior lira strengthening with the growth of the shell until, on the adult whorls, it is much more elevated than the anterior lira, forming a prominent subsutural carination; an indistinct secondary revolving lira appearing just in front of the suture on the adult whorls, but never becoming conspicuous. Incrementals indistinct, deeply arcuate, the maximum curvature falling just in front of the posterior carina, sharply recurved just behind the suture. Aperture not preserved entire.

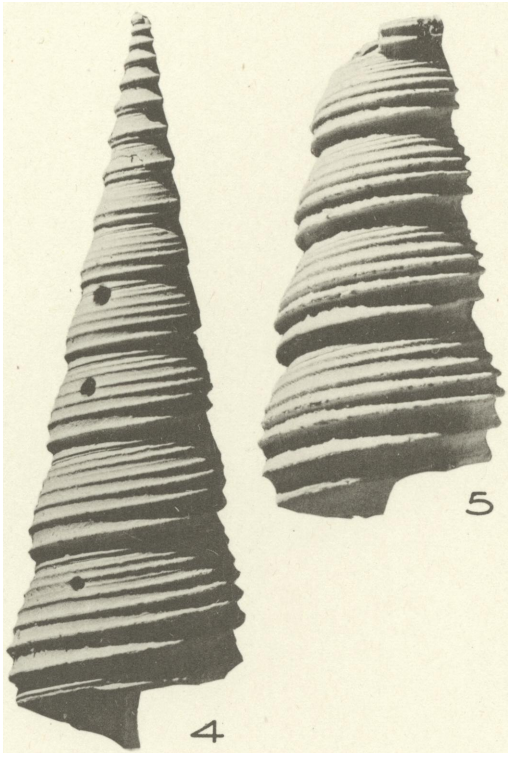
Dimensions: Holotype, height, 30 mm; greatest diameter, 11 mm. Paratype, height, 22 mm; greatest diameter, 9 mm.

Observations (slightly modified from Bowles 1939): Turritella cortezi is one of the most distinctive of the Claiborne Turritellas. It most closely resembles *T. rina subrina* Palmer of the Lisbon formation of Alabama, but in the northern species the two revolving carinae are subequal in strength, and between the posterior primary carina and the posterior suture is a fairly strong secondary cord. In *T. cortezi* the subsutural carina is very prominent, the anterior less strongly developed, and the secondary cord inconspicuous or absent.

Observations (Stenzel & Turner): The first nepionic whorls have 3 primary spirals; posterior rib faint, medial and basal ribs prominent. Posterior primary rib gradually increases as the medial rib decreases so that with the 6th or 7th whorl the whorls are widely bicarinate with a fine line medially; later the medial line disappears entirely.

Young specimens of *T. cortezi* can hardly be distinguished from those of *T. rina subrina* Palmer. These two species and *T. rina* Palmer and *T. rina carolina* form a near related group.

ARENICOLA DANVILLENSIS STENZEL & TURNER



Figs. 4,5 —syntypes, X 3.

Type Data: Syntypes in Stenzel collection, Austin, Texas.

Type Locality: Bluff on right bank of Ouachita River at Danville Landing on boundary between Caldwell and Catahoula parishes, Louisiana; Bureau of Economic Geology locality No. La–9.

For exact location, compare Chawner, W. D., Geology of Concordia and Catahoula parishes: Louisiana Geol. Surv., Geol. Bull. 9, 1936.

Geologic Horizon: Danville Landing beds, upper Jackson group, upper Eocene.

Distribution: Known at present only from type locality.

Synonymy:

1940 *Turritella arenicola danvillensis* Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 841, pl. 47, figs. 4, 5.

Original Description: Apical angle 24° juvenile, 14° adult; shell profile slightly convex. First two apical whorls smooth; two median, equal, and closely spaced primary revolving ribs appear on third whorl; as the anterior of these two ribs becomes gradually weaker and disappears on seventh or eighth whorl the other primary forms a prominent carina situated a little anterior to the median of the whorl; anterior primary reappears on ninth or tenth whorl and increases gradually in size until it becomes equal to the other on the adult whorls; 3 to 4 accessory ribs are added between the primaries and the posterior suture; a few fine threads arise between the ribs. Adult whorls convex with the greatest diameter at the level of the 2 primaries; ornamentation consists of 5 or 6 sharply raised spirals, of which the 2 anterior ones are most conspicuous, and a few scattered fine spiral threads; area just behind the suture excavated. Base of body whorl set off by a sharp spiral rib, which is hidden by the suture on the spire whorls. Incrementals most advanced at posterior suture, less so at anterior suture, to which they descend at a steep angle; sinus centers posterior to the primary rib.

This subspecies differs from typical *T. arenicola* Conrad by the usually more sharply raised spiral ribs, the smaller number of ribs and threads, the greater convexity of the adult whorls, and the short bicarinate stage on the apical whorls which precedes the usual unicarinate stage usual in the *T. arenicola* group.

Prepared by H. B. Stenzel & F. E. Turner, Bureau of Economic Geology, Austin, Texas.

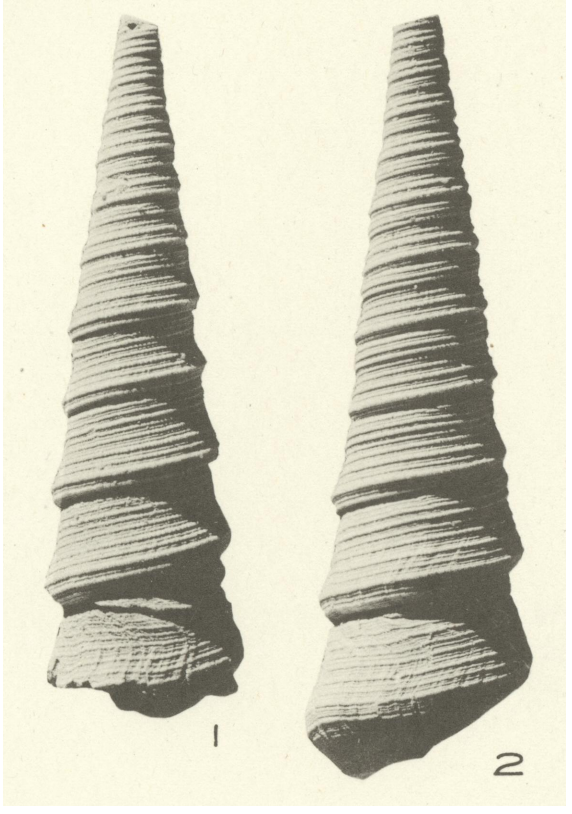


Fig. 1—lectoholotype, X 3,
Fig. 2—lectoparatype, X 3.

Type Data: Four syntypes, No. 1591, Geology Dept., The University of Texas, Austin, Texas.

Type Locality: Stone City (Moseleys Ferry), bluff on right of bank of Brazos River at bridge of State highway No. 21 and bridge of Southern Pacific Railroad, Burleson County, Texas.

Geologic Horizon: Stone City formation, Claiborne group, middle Eocene.

Distribution: Stone City formation, central and south Texas. This species has not been observed in beds higher than the Stone City.

Synonymy:

1895 *Turritella dumblei* Harris, G. D., New and otherwise interesting Tertiary Mollusca from Texas: Acad. Nat. Sci. Philadelphia, Proc. for 1895, p. 81, 82, pl. 9, fig. 7.

1937 Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 202, pl. 26, fig. 10(?), 11, 15.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 303, 304, figs. 9, 19.

Original Description: Size and general form as shown by the figure; whorls about 15; the lower two to four show an obtuse basal carination while above, this feature is not so apparent; surface marked by raised spiral lines alternating in size, the carinal zones of the lower whorls are marked by two somewhat stronger lines; lines of growth plainly cutting the spiral lines and causing them to appear under a glass like diminutive strings of beads.

This species reminds one somewhat of *T. alabamiensis* Whitf., but is most probably nearest allied to *T. infragranulata* Gabb (Geo. Surv. Cal., Pal., vol. 1, 1864, p. 212, pl. 32, fig. 279), from near Martinez, Cal. Wherever the lines of growth are strong over the basal carina they tend to produce an *"infragranulata"* appearance.

Observations: Apical whorls marked by 3 subequal prominent revolving lirae with the anterior two very slightly closer together; anterior lira develops more rapidly in size and occupies the periphery of the rounded anterior angulation; whorl profile concave between anterior angulation and the narrow sutural collar. Secondary lirae arise anterior and posterior to and between the primaries until there are 6–8 subequal lirae on the adult whorls with fine striations in between. Growth lines almost straight across posterior third of the shell leaving at a 38° angle from the suture, curving sharply and swinging forward toward the angulation at an angle of 22° with the axis of the shell, inflected backward at the angulation of the whorl.

DUTEXATA HARRIS

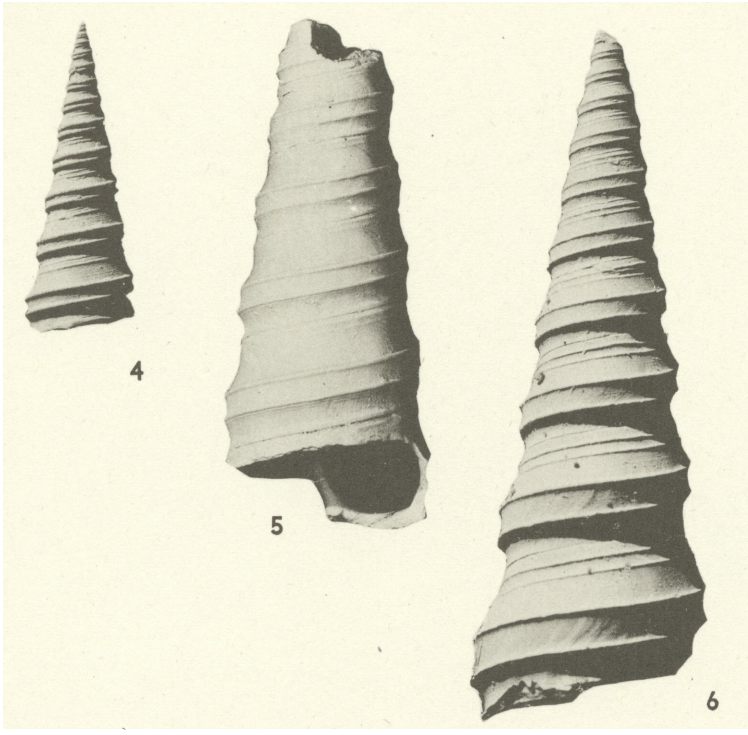


Fig. 5—holotype, X 3,

Figs. 4, 6—specimens, X 3, from 3.6 miles west of Quitman, Jackson Parish, Louisiana.

Type Data: Holotype, No. 1974, in Geology Dept., The University of Texas, Austin, Texas.

Type Locality: From Orells to Prices Crossing over Elm Creek, Lee County, Texas.

Geologic Horizon: Basal Landrum member, Cook Mountain formation, Claiborne group, middle Eocene.

Distribution: Cook Mountain formation, Claiborne group, middle Eocene, in Texas and Louisiana.

Synonymy:

1895 *Turritella dutexata* Harris, G. D., New and otherwise interesting Mollusca from Texas: Acad. Nat. Sci. Philadelphia, Proc. for 1895, p. 82, pl. 9, fig. 8.

1937 Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 198, 199, pl. 26, figs. 2, 3, 4. Not figs. 1, 8, 9.

1939 Not *T. dutexata*, Bowles, E., Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 285–286, pl. 31, fig. 2 = *T. femina* Stenzel.

1940 *Turritella dutexata*, Stenzel, H. B., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 833, 834, pl. 46, figs. 4–6.

Original Description: Whorls (in a complete specimen) about 15; all marked by two subcentral carinal lines together with one small one just below and one just above the suture.

Besides the ornamentation shown on the specimen figured, there are usually about four spiral striae on each whorl between the upper carinal and subsutural line; between the two strong carinal lines there is often a faint stria; likewise one often appears just below the lower carina. When fully striated this species bears a general resemblance to *T. arenicola* and *T. arenicola* var. *branneri*, but may be distinguished at once by the persistency of the bicarinate feature of the whorls to the very apex. The apical whorls of *T. arenicola* and variety are unicarinate somewhat as in *T. carinata* H. C. Lea (*T. apita* De Greg.). It will be observed that in Meyer's carefully drawn figure of *T. carinata* H. C. Lea, in the Proc. Ac. Nat. Sci. Phila., 1887, p. 54, pl. 3, fig. 1, 1a, two carinae are represented on each whorl, but it is the upper one which predominates on the apical whorls; in *dutexata* it is the lower.

Revised Description: Apical angle 20°; shell profile straight. First 2½ whorls smooth and convex, next half whorl unicarinate at anterior third of whorl; a second primary carina is added posterior to the first on the third whorl. The two primary carinae are equal in size and continue prominent on all later whorls. A secondary lira is added on the sixth or seventh whorl just anterior to the suture; one or two secondary lirae are added next to the first secondary on later whorls. Adult whorls have 2 strong and equal primary carinae in the anterior half of the whorls, 1 to 3 weak secondary lirae near the posterior suture, perhaps one weak secondary lira at the anterior suture, and numerous obsolete threads covering the entire whorl; whorls slightly inflated, inflation increasing with age. Characteristic of this species is the bare appearance of the adult whorls save for the two conspicuous primary spirals.

Observations: The second paragraph of Harris' description includes other species besides *T. dutexata.*

Secondary ribs and less conspicuous primary carinae are present on *T. dutexata lisbonensis* Bowles; trilirate adolescent whorls are present on *T. nasuta brazita* Stenzel & Turner; adult whorls of *T. femina* Stenzel are more inflated and have many secondary lirae.

Turritella dutexata does not occur together with *T. femina* Stenzel or *T. femina oligoploka* Stenzel.

ELONGATA (WHITFIELD)

Figs. 13–15—syntypes, Whitfield 1892.

Type Data: Types presumably in American Mus. Nat. History, New York, and Department of Geology, Rutgers University, New Brunswick, New Jersey.

Geologic Horizon: Shark River marl, middle Eocene.

Distribution: Known only from type locality.

Type Locality: Shark River, Monmouth County, New Jersey.

Synonymy:

1892 *Mesalia elongata* Whitfield, R. P., Gasteropoda and Cephalopoda of the Raritan clays and greensand marls of New Jersey: U. S. Geol. Survey Mon. 18, p. 230–231, pl. 34, figs. 13–15.

Original Description: Shell attaining a very respectable size, slender, elongated, many whorled, the number unknown, but certainly twelve or more, the rate of increase in lateral dimensions very moderate; volutions rounded, with only moderately marked suture lines dividing them, but usually wider than high; shell quite thin, judging from the spaces left by its removal from between the volutions on the casts; surface on the shell marked by eight or nine sharply elevated, salient spiral ridges on each volution between the sutures, the number on the last volution not ascertained; these ridges are divided by concave interspaces, and are moderately regular, though in several cases the two next above the suture are somewhat more distant than those above; this feature, however, does not hold good in all cases. There are also faint indications in the matrices of fine transverse lines of growth crossing the ridges, and strongly directed backward in passing from the suture downward on the matrix, indicating a broad sinuous lip in the shell. Form of the aperture, columella, and base of lip unknown.

The species is represented by numerous examples, both of internal casts and matrices, but always flattened to a greater or less extent. Some of these indicate specimens of not less than 2½ inches in length, probably considerably more, and have a breadth across the lower volution of over half an inch, with probably half the number of volutions absent. It is just possible that these casts represent a thin-shelled *Turritella* with rounded volutions; still the surface striae or ridges are much more like those of *Mesalia*, but the form of the aperture and lip being unknown, the final determination of their true generic relations must be left for future discovery. The spire differs so totally in its great elevation and very moderate increase in diameter from that of any other species I know, that there seems no difficulty in distinguishing it.

Observations: Superficially the external molds of this species seem to resemble *T. nasuta felli* more than any of the other Eocene Turritellas. The gutta percha impression fig. 13 shows more subquadrate whorl outlines than any of the known Eocene species.

The species is very poorly known due to the state of preservation. The specific name is preoccupied by *Turritella elongata* J. Sowerby 1814.

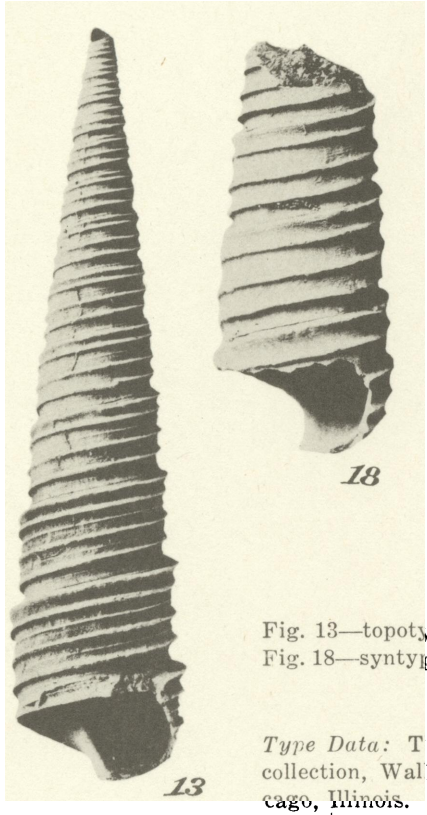


Fig. 13—topotype, X 2,
Fig. 18—syntype, X 2; Bowles 1939.

Type Data: Three syntypes No. 24505, James Hall collection, Walker Museum, Univ. of Chicago, Chicago, Illinois.

Type Locality: Probably Greggs Landing, right bank of Alabama River west of Tinela, Monroe County, Alabama. Mistakenly given as six miles above Claiborne, Alabama, on the west side of the river by Whitfield (compare Aldrich, T. H., Notes on Tertiary fossils, with descriptions of new species: Cincinnati Soc. Nat. History Jour., vol. 10, p. 79, 1887).

Geologic Horizon: Tuscahoma formation, Wilcox group, lower Eocene.

Distribution: Tuscahoma formation of Alabama.

Synonymy:

1865 *Turritella eurynome* Whitfield, R. P., Descriptions of new species of Eocene fossils: Am. Jour. Conchology, vol. 1, p. 267.

1899 Harris, G. D., The Lignitic stage: Bull. Am. Paleontology, vol. 3, p. 75, pl. 10, fig. 7.

1933 *Turritella* sp., Plummer, F. B., Cenozoic systems in Texas, *in* The Geology of Texas: Univ. Texas Bull. 3232, pl. 10, fig. 9.

1939 *Turritella eurynome*, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 292, pl. 31, fig. 13, pl. 32, fig. 18.

Original Description: Shell elongate, very gradually tapering; volutions flattened; surface marked by four strong, well-defined revolving ridges, with sometimes an intermediate finer one on the middle of the volution; the four ridges are arranged in pairs, with flattened spaces between, the central space wider than the others; the upper carina marks the upper margin of the volution, while the lower one is as far from the lower margin as the breadth of the space between the upper pair; under side of volution marked by four or more less distinct ridges; volutions crossed by distinct lines of growth, having a strong retral curvature, embracing the entire surface; aperture elongate-ovate.

Observations: When typically developed *T. eurynome* is quite distinct from any of the other Turritellas of the Wilcox. The straight-sided whorls with four prominent revolving lirae in the adult stages well characterize the species. Some specimens have these 4 major ribs weakly developed and have in addition numerous secondary intercalated ribs. Occasionally, however, the posterior lira becomes strongly developed and approximates the prominent carina of *T. bellifera* Aldrich, a species with which it is associated at Bell's and Gregg's Landings. The trilirate apical whorls, however, readily distinguish this species from *T. bellifera* and other members of the *T. humerosa* Conrad group, and the lack of a basal carina separates it from the tricostate group of *Turritella mortoni* Conrad.

NASUTA FELLI BOWLES

Fig. 8—holotype, Bowles 1939.

Type Data: Holotype No. 498005, U. S. Nat. Mus., Washington, D.C.

Type Locality: Bluff about one mile south of Lisbon Landing on right bank of Alabama River, Monroe County, Alabama.

Geologic Horizon: Lisbon formation, Claiborne group, middle Eocene.

Distribution: McBean formation of Georgia and Lisbon formation of Alabama and Mississippi, both in Claiborne group, middle Eocene.

Synonymy:

1937 *Turritella nasuta* [in part], Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 200, pl. 25, figs. 1, 2, 8 only.

1939 *Turritella nasuta felli* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 290, pl. 32, figs. 4(?), 8.

Original Description: Shell large. Spire high, narrow, very gradually tapering. Whorls numerous, wider than high, very slightly rounded, not sharply constricted at the sutures. Sutures linear but distinct, not deeply impressed. Earliest whorls unknown; first apical whorl preserved exhibiting three subequal revolving lirae, the middle one closer to the anterior than to the posterior lira, the distance between the posterior lira and the suture less than that between the anterior lira and the suture; anterior primary becoming relatively more prominent in adolescence; a smaller, secondary cord appearing between the two posterior primaries early in adolescence, an additional secondary arising between the two anterior primaries a few whorls later, and a third subordinate lira appearing between the posterior primary and the suture late in adolescence; the two posterior secondaries rapidly increasing in prominence until on the adult whorls they are equal in strength to the three primaries, the secondary between the two anterior primaries remaining small; a variable number of additional fine, revolving lines added on the adult whorls between the prominent cords; adult whorls typically marked by five strong and four weak revolving lirae, some specimens exhibiting five to eight strong revolving lines. Incrementals prominent, deeply flexed at about the median of the whorl and slightly reflexed at the anterior suture. Aperture not preserved complete.

Dimensions: Holotype, height, 43.0 mm; greatest diameter, 7.5 mm. Figured specimen, height, 33.0 mm; greatest diameter, 6.5 mm.

Observations (Bowles 1939): Turritella nasuta felli differs from typical *nasuta* of the western Gulf province in its larger size and its much more prominent adult sculpture. The subspecies is restricted to the Claiborne of the eastern Gulf region, being found only in the Lisbon formation of Alabama and the correlative McBean formation of Georgia.

The citations of *Turritella nasuta* by Stephenson and Veatch (1911, 1915) in their Georgia reports are references to this species.

Mrs. Palmer (1937, p. 201) called attention to the great variety of forms included under Gabb's original name in the literature, and she figured a number of these variants, some of which are herein described.

FEMINA STENZEL

TURRITELLA

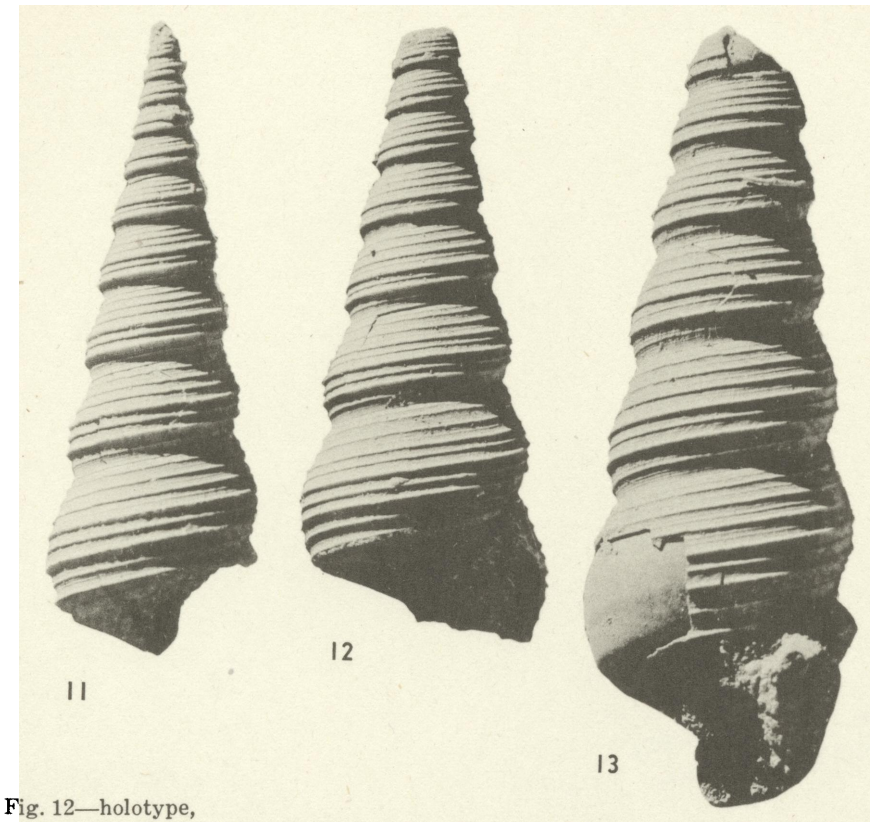


Fig. 12—holotype,
Figs. 11, 13—paratypes; all X 3.

Type Data: Holotype and numerous paratypes in Stenzel collection, Austin, Texas.

Type Locality: Bluff on right bank of Cobb Branch near its head, 0.6 mile northwest of Camp Creek schoolhouse, on Buck McBride's 134-acre tract; Jose Maria Viesca survey, eastern Robertson County, Texas. Compare Marquez quadrangle, scale 1/62500, U. S. Geological Survey.

Geologic Horizon: Viesca member, Weches formation, Claiborne group, middle Eocene.

Distribution: Weches formation of central and east Texas.

Synonymy:

1931 *Turritella femina* Stenzel *in* Renick, B. C., & Stenzel, H. B., The lower Claiborne on the Brazos River, Texas: Univ. Texas Bull. 3101, p. 87, 89, 107, pl. 6, fig. 14.

1933 Plummer, F. B., Cenozoic systems in Texas, *in* The Geology of Texas: Univ. Texas Bull. 3232, p. 644, 647, 815.

1937 Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 203, pl. 26, fig. 5.

1939 *Turritella dutexata*, Bowles, Edgar, The Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 285, pl. 31, fig. 2.

1940 *Turritella femina* Stenzel, H. B., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 830, 831, pl. 46, figs. 11–13.

Original Description (Stenzel 1940): Apical angle 13° juvenile, 14° to 22° adult; spire profile concave near the apex. First two apical whorls smooth; at end of second volution appear 2 lirae of which the anterior appears slightly earlier and is slightly higher; these two primaries are prominent in the juvenile stage and remain larger than any other rib during the entire growth of the shell, giving even the adult whorls a slightly bicarinate appearance. One-half volution later a third, weaker, primary lira appears posterior to the two; on sixth whorl a secondary lira appears next to the posterior suture; on eighth whorl a secondary lira appears between the two posterior primaries and another secondary between the anterior suture and the most anterior of the 3 primaries; on ninth whorl appears a fourth secondary lira between the two anterior primaries. Additional spirals are added on the whorl chiefly posterior of the 2 prominent primaries and some of these spirals may reach the size of the secondaries, so that the adult whorls may have up to 9 larger ribs and numerous fine threads between them. The ribs and threads are usually arranged by alternating sizes.

The adult whorl shape is highly inflated with the greatest width at the 2 major primary lirae.

Observations: This species is related to *T. dutexata* Harris from which it is readily distinguished by the much greater number of ribs; *T. femina* differs from *T. dutexata lisbonensis* Bowles by the concave spire profile and the inflated whorls.

Turritella femina Stenzel and *T. femina oligoploka* Stenzel are end members of a continuous series of variants.

GHIGNA DE GREGORIO

TURRITELLA

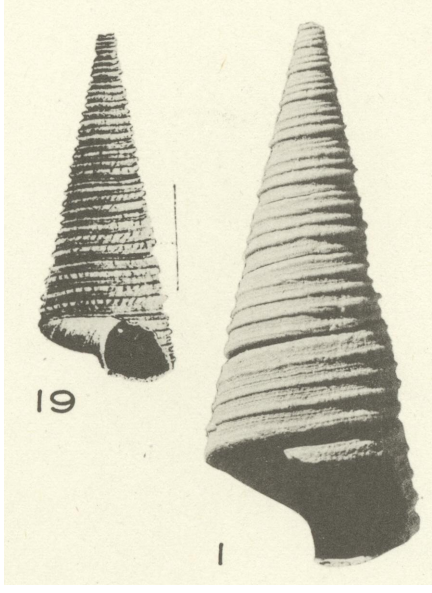


Fig. 19—holotype, De Gregorio 1890.
Fig. 1—topotype, X 3.

Type Data: Holotype in De Gregorio home, Via Molo 132, Palermo, Sicily. Topotype in Bureau of Economic Geology, The University of Texas, Austin, Texas.

Type Locality: Claiborne Bluff on left bank of Alabama River, Monroe County, Alabama.

Geologic Horizon: Gosport sand, Claiborne group, middle Eocene.

Distribution: Gosport sand of Alabama.

Synonymy:

1890 *Turritella ghigna* + *carinifera* var. *claibornensis* + *mela* + *hybrida* de Gregorio, A., Monographie de la faune éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 125, 126, 127, pl. 11, figs. 19, 23, 24, 33, 40. Not *T. hybrida* Deshayes 1832.

1937 *T. ghigna*, Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 191, 192, pl. 24, figs. 2, 4, 11, 13–15.

1939 *T. carinata* in part, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 304, 305.

Original Description (translated): Test conical, elegant; whorls flat, closely and very minutely spirally striated with 3 distinct lirae; lirae crenulate; near the suture there is often a slender liriform cord.

Observations: Apex acute; apical angle 23°, early whorls have 2, later 3, spirals with the posterior the weakest. Adults have typically 5 spirals, the 2 additional spirals being added anterior and posterior to the original 3; fifth spiral occasionally forms a sharp carina; faint spiral striations appear over entire surface of whorl; base has faint spiral ribs with intervening striations. As pointed out by Palmer 1937 and Bowles 1939 there is complete gradation from *T. carinata* Lea to *T. ghigna* De Gregorio which are end members of the same species.

GILBERTI BOWLES

TURRITELLA

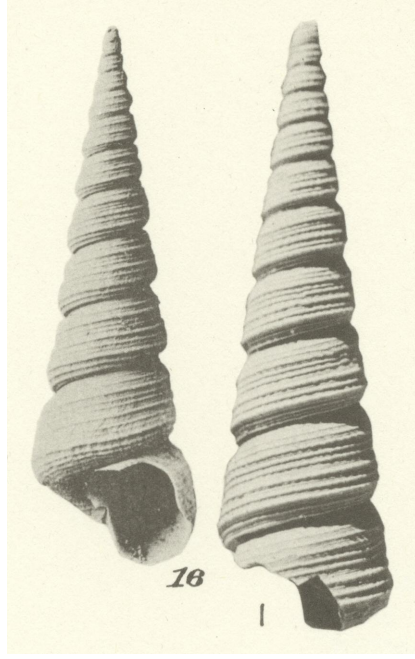


Fig. 16—holotype, X 2, Bowles 1939.
Fig. 1—topotype, X 3.

Type Data: Holotype No. 494993, U. S. Nat. Mus., Washington, D.C.

Type Locality: Woods Bluff on left bank of Tombigbee River, at lock and dam No. 1, near town of Woodbluff, northwestern Clarke County, Alabama.

Geologic Horizon: Bashi formation, Wilcox group, lower Eocene.

Distribution: Bashi formation of Alabama and Mississippi.

Synonymy:

1899 *Turritella clevelandia* var. Harris, G. D., The Lignitic stage: Bull. Am. Paleontology, vol. 3, p. 74, pl. 10, fig. 2.

1939 *Turritella gilberti* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 302, pl. 32, fig. 16.

Original Description: Shell small. Spire acute, gently tapering. Whorls numerous, straight-sided in the apical stages, slightly carinated basally in the adolescent and adult. Sutures distinct and very deeply impressed; linear, not channelled; not overhung by the whorls and giving a suggestion of loose coiling. Apical whorls marked by three distinct, subequal revolving cords, equidistant from each other, the anterior lira slightly closer to the anterior suture than the posterior lira is to the posterior suture; a secondary line appearing between the two anterior primary lirae on the sixth whorl, and another between the two posterior on the seventh; other accessory lines constantly added so that on the body whorl of the holotype there are eight liration in addition to the three primary cords, some of the secondary lines approaching the primary lirae in size; whorls sharply undercut and constricted toward the suture immediately below the anterior primary lira, forming a slight carination, most evident on the adult stages. Incrementals deeply arcuate, the maximum retraction being reached at about the posterior third of the whorl, recurving slightly below the carination. Parietal wash inconspicuous. Aperture rhomboidal, its longest dimension paralleling the axis of the spire; outer lip very thin and fragile, not observed entire.

Dimensions: Holotype, height, 35.5 mm; greatest diameter, 10.0 mm.

Observations (Bowles 1939): Turritella gilberti is the only species recognized in the upper Wilcox formations of the Gulf Province. The deeply incised sutures, with the whorls constricted both before and behind them, distinguish this species from any other in the lower Eocene. The closest analogue seems to be *Turritella potomacensis* Clark and Martin from the Nanjemoy formation of Maryland, but in the northern species the whorls are less rhomboidal and the sutures less deeply incised.

There is a strong resemblance between *Turritella gilberti* and the Jackson species *Turritella clevelandia* Harris, but the younger species is even more loosely coiled and may be readily distinguished.

HALENSIS DALL

TURRITELLA

Fig. 9—holotype, Dall 1916.

Type Data: Holotype No. 166741, U. S. Nat. Mus., Washington, D.C.

Type Locality: In coralliferous chert on the west bank of Flint River, 7 miles southwest of Bainbridge at Hale Landing, Decatur County, Georgia. Mistakenly given as southeast of Bainbridge by Dall.

Geologic Horizon: Flint River formation, Oligocene.

Distribution: Flint River formation of Decatur County, Georgia.

Synonymy:

1916 *Turritella halensis* Dall, W. H., A contribution to the invertebrate fauna of the Oligocene beds of Flint River: U. S. Nat. Mus. Proc., vol. 51, p. 517, pl. 86, fig. 9.

Original Description: Only a mold of about five whorls of this species is available, but the sculpture differs from that of any of the Tampa species and it therefore seems proper to describe it. The whorls increase in diameter very slowly and overhang somewhat at the suture. The spiral sculpture comprises on the best preserved whorl two or three minor threads in front of the suture; then one simple, more elevated major spiral; then a constriction carrying two minor threads with equal interspaces, in which are a few faint spiral striae; then a stronger and more prominent major spiral, simple and forming the periphery of the whorl; this spiral grows proportionately more prominent as the whorls succeed one another. In front of this and separated by a faintly spirally striated equal interspace is a third simple major spiral overhanging the next suture, and which in the earlier whorls is about equal in strength to the major spiral behind it, but in the later ones is somewhat weaker. Height of the three best preserved whorls, 21; diameter of the earlier of the three, 9.5; of the latest of the three, 14 mm. The base and apex of the shell are defective.

Observations: This species shows a marked resemblance to *T. subtilis* Kellum from the Castle Hayne marl of North Carolina.

Fig. 4—paratype, greatest diameter 12.6 mm.,

Fig. 5—paratype, greatest diameter 7.3 mm.,

Fig. 6—holotype, height of incomplete spire 36.0 mm.; all from Gardner 1935.

Figs. 1, 2—topotypes, X 3.

Type Data: Holotype and 2 paratypes, No. 373054, U. S. Nat. Mus., Washington, D.C.

Type Locality: Right bank of Colorado River, ¼ mile below the mouth of Dry Creek and approximately 1¼ miles below the Bastrop-Travis County line, Bastrop County, Texas.

Geologic Horizon: Upper Kincaid formation, Midway group, Paleocene.

Distribution: Upper Kincaid formation of central Texas.

Synonymy:

1933 *Turritella levicunea,* Plummer, F. B., Cenozoic systems in Texas, *in* The Geology of Texas: Univ. Texas Bull. 3232, p. 815, 816, pl. 10, figs. 4, 4a. Not *Turritella mortoni* var. *levicunea* Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 224, pl. 21, fig. 9, 1896.

1935 *Turritella hilli* Gardner, J. A., The Midway group of Texas: Univ. Texas Bull. 3301, p. 292, 293, pl. 25, figs. 4–6.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, pp. 301, 302.

Original Description: Shell rather small for the genus, not very heavy. Apical angle between 20° and 25°, the early whorls evenly trapezoidal, the later marked by a broad and shallow medial depression and with an increasingly prominent overhang directly behind the anterior suture. Early apical whorls sculptured with 2 strong simple spirals on the anterior half of the whorl, another of almost equal strength a little behind the middle and except on the very earliest whorls, a finer spiral directly in front of the posterior suture. Intercalaries introduced between the primary spirals and between the spirals and the suture lines, the anterior of the primary spirals following the peripheral keel of the later whorls. Spirals on adult whorls irregular in size and spacing; the coarsest spirals, 1 to 4 in number, at the periphery and directly in front of or behind it; those on the posterior fourth of the whorl obliterated on the latest adult volutions by the overriding growth lines; adult spirals tending to be wavy and dissected by strong and crinkled incrementals bent backward in a broad and symmetrical U. No perfect apertures observed.

Dimensions.—Height of holotype (incomplete), 36.0 millimeters; diameter of holotype, 13.0 millimeters.

Observations: The species attains a considerably greater size than indicated by the types. *Turritella alabamiensis* Whitfield from Alabama has a smaller apical angle and does not develop a sharp-edged carina.

HOUSTONIA HARRIS

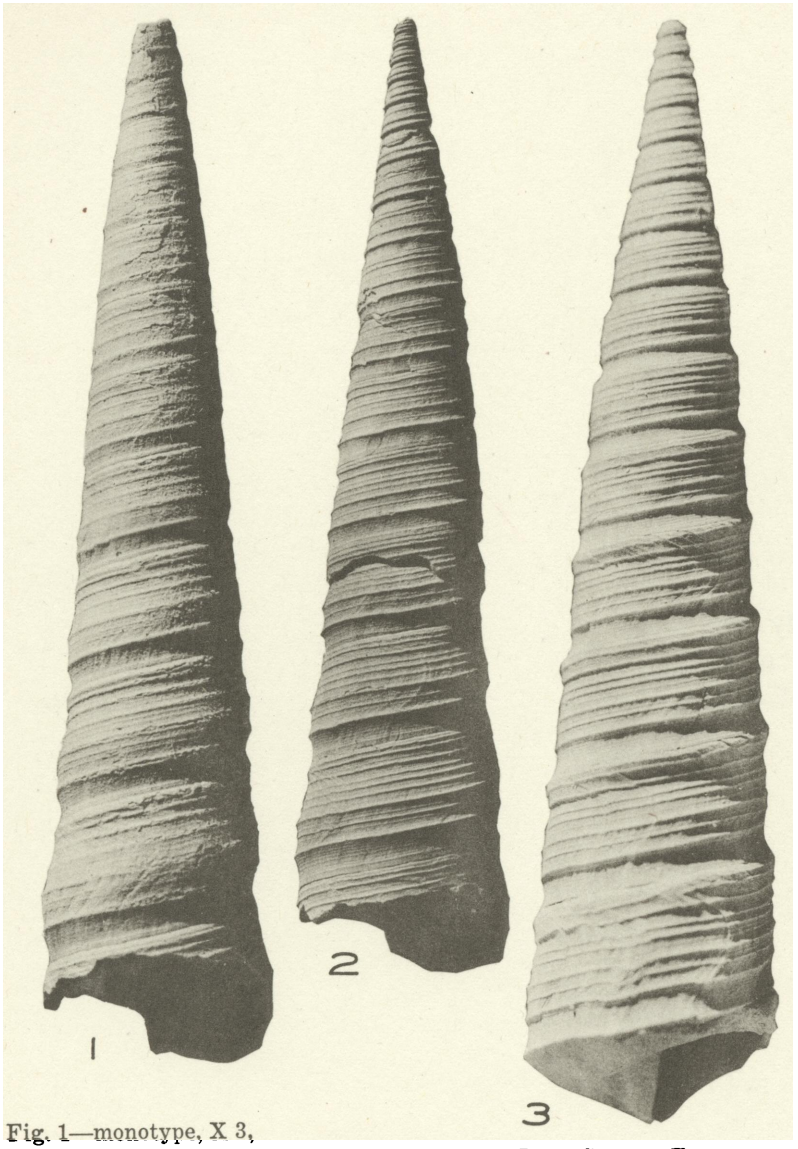


Fig. 1—monotype, X 3,
Fig. 2—specimen, X 3, from locality 145–T–71, Leon County, Texas,
Fig. 3—specimen, X 3, from Stone City, Burleson County, Texas.

Type Data: Monotype No. 1555, Geology Dept., The University of Texas, Austin, Texas.

TURRITELLA

Synonymy:

1895 *Turritella nasuta* var. *houstonia* Harris, G. D., New and otherwise interesting Tertiary Mollusca from Texas: Acad. Nat. Sci. Philadelphia, Proc. for 1895, p. 81, pl. 9, fig. 6.

1937 *T. nasuta houstonia*, Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda from the southern United States: Bull. Am. Paleontology, vol. 7, p. 201, pl. 25, figs. 4, 7(?), 10, not fig. 11.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 291, 292, pl. 32, fig. 2, not fig. 11.

Original Description: This variety differs from typical *nasuta* in being much broader at base, and having its whorls rounded or slightly carinated submedially. It is generally somewhat larger than the typical form, and is closely related to Conrad's *Mesalia lintea.*

Observations: Shell largest of Texas Claiborne Turritellas; apical angle early whorls 18°, adult whorls 9°, giving shell a convex profile, whorls wider than high, straight-sided to slightly inflated, sutures distinct and linear. Apical whorls marked by 2 prominent subequal revolving lirae with a smaller less prominent lira posterior to them. Additional lirae appear in adolescence, usually a pair around the slight sutural collar, one between this pair and the posterior primary, and another between the middle and anterior primaries; primaries commonly slightly stronger than secondaries; interspaces crowded with fine revolving striae.

Characteristic of this species is the prominently convex spire profile, the large size, subdued ornamentation, and the excavated band posterior to the sutures.

Type Locality: Alabama Ferry, left bank of Trinity River 0.3 mile below abandoned ferry, 7.5 miles west-southwest of Porter Springs, Houston County, Texas.

Geologic Horizon: Hurricane lentil in lower Landrum member, Cook Mountain formation, Claiborne group, middle Eocene.

For stratigraphy of type locality see Stenzel, H. B., New zone in Cook Mountain formation, the *Crassatella texalta* Harris—*Turritella cortezi* Bowles zone: Am. Assoc. Petroleum Geologists Bull., vol. 24, no. 9, p. 1663–1675, 1940.

Distribution: Stone City beds and Hurricane lentil of lower Landrum member of Cook Mountain formation in Texas and Lisbon formation in Alabama. In Texas the species seems to be restricted to glauconitic beds intercalated in brown nonfossiliferous shales, such as the Stone City beds and the lower Landrum member. This may mean that it is an indicator of proximity to brackish water.

HUMEROSA CONRAD

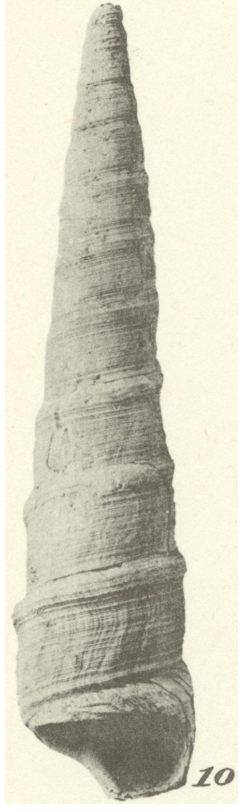


Fig. 10—topotype, Bowles 1939.

Type Data: A lectotype and 4 paratypes in Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania. Figured topotype, Bowles 1939, No. 497994, U. S. Nat. Mus., Washington, D.C.

Type Locality: Piscataway, Prince Georges County, Maryland.

Geologic Horizon: Aquia formation, Wilcox group, lower Eocene.

Distribution: Aquia formation of Maryland and Virginia.

Synonymy:

1885 *Turritella humerosa* Conrad, T. A., Observations on a portion of the Atlantic Tertiary region: Geol. Soc. Pennsylvania Trans., vol. 1, pt. 2, p. 340, pl. 13, fig. 3.

1896 Clark, W. B., The Eocene deposits of the Middle Atlantic slope in Delaware, Maryland, and Virginia: U. S. Geol. Survey Bull. 141, p. 70, pl. 14, fig. 1.

1896 Not Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, pl. 21, figs. 10–13.

1899 Not Harris, G. D., The Lignitic stage: Bull. Am. Paleontology, vol. 3, pl. 10, figs. 5–7.

1899 Not Harris, G. D., A preliminary report on the geology of Louisiana: Louisiana Geol. Survey, Rept. for 1899, p. 308, pl. 55, fig. 6 = *T. bellifera* Aldrich.

1901 Clark, W. B., & Martin, G. C., Systematic paleontology, Eocene, Mollusca: Maryland Geol. Survey, Eocene, p. 148, 149, pl. 27, figs. 1, 1a.

1926 Not Cooke, C. W., The Cenozoic formation, *in* Geology of Alabama: Alabama Geol. Survey, Special Rept. 14, pl. 94, fig. 1 = *T. multilira* Whitfield.

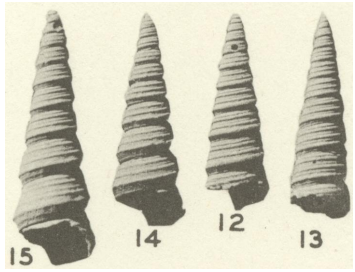
1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 312, 313, pl. 33, fig. 10.

Original Description: Shell turrited, subulate; whorls with fine regular revolving striae; an obtuse slight elevation on the summit, a shallow groove at base of each.

Observations: Shell large, slender; whorls straight-sided in adolescent stage, in adult stage with a slight rounded subsutural carina. Extreme apex not preserved. Earliest whorls observed have 3–5 small subequal revolving lirae; additional lirae introduced early, becoming numerous on the later whorls. Adults have 30 or more fine subequal lirae distributed over entire surface of whorl. Subsutural carina formed by thickening of the whorl rather than by enlargement of one of the primary lirae.

Turritella humerosa differs from *T. bellifera* Aldrich in its finer and more numerous spiral lirae and more rounded and less prominent subsutural collar. *Turritella humerosa biboraensis* Gardner is more slender and has finer lirae.

INFANS STENZEL & TURNER



Figs. 12–15—syntypes, X 3.

Type Data: Holotype and numerous paratypes in Stenzel collection, Austin, Texas.

Type Locality: Stone City (or Moseleys Ferry), bluff on right bank of Brazos River at bridge of State highway No. 21 and bridge of Southern Pacific Railroad, Burleson County, Texas; Bureau of Economic Geology locality No. 26–T–1.

Geologic Horizon: Basal Wheelock member of Cook Mountain formation, Claiborne group, middle Eocene, Texas.

Distribution: Base of Cook Mountain formation, Brazos and Burleson counties, Texas. The species is abundant in the basal 9 feet of the formation.

Synonymy:

1931 *Turritella dumblei*, Stenzel *in* Renick, B. C., & Stenzel, H. B., The lower Claiborne on the Brazos River, Texas: Univ. Texas Bull. 3101, p. 102.

1940 *Turritella infans* Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 838, pl. 47, figs. 12–15.

Original Description: Shell small; apical angle juvenile 20°–27°, adult 15°–20°; profile of early portion of shell convex. Whorls angulated near the anterior suture making the suture appear deeply channelled. First 3 whorls smooth, 3 primary lirae begin faintly on fourth whorl and increase rapidly in strength and persist as strong lirae on adult whorls, a fourth lira appears commonly immediately anterior to the suture. The anterior one of the 3 strong lirae is situated on the angle of the whorl. Additional lirae are rare. Beading on lirae very faint. Revolving striae between the strong lirae usually obsolete.

Distinguished from *T. turneri* Plummer by the convex profile of the early portion of the shell and the greater apical angle and lesser development of beading and fine striae between the strong lirae.

Prepared by H. B. Stenzel & F. E. Turner, Bureau of Economic Geology, Austin, Texas.

PERDITA JACKSONENSIS COOKE

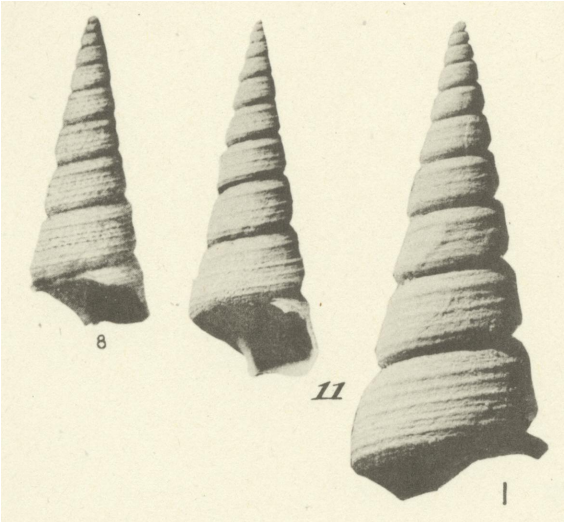


Fig. 8—holotype, X 2, Cooke 1926.
Fig. 11—topotype, X 2, Bowles 1939.
Fig. 1—topotype, X 3.

Type Data: Holotype No. 353945, U. S. Nat. Mus., Washington, D.C.

Type Locality: Moodys Branch, cliff on right bank of branch, near intersection of Peachtree Street and Poplar Boulevard, in northern part of Jackson, Hinds County, Mississippi.

Geologic Horizon: Moodys marl, Jackson group, upper Eocene.

Distribution: Known only from type locality.

Synonymy:

1926 *Turritella jacksonensis* Cooke, C. W., New Eocene Mollusca from Jackson, Mississippi: Washington Acad. Sci. Jour., vol. 16, p. 136, fig. 8.

1939 *Turritella perdita* [in part], Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 307, pl. 32, fig. 11.

Original Description: Shell rapidly expanding; apical angle 25°, suture impressed. Whorls postero-medially constricted, twice as broad as high, ornamented with faintly nodular spiral threads which continue over the base. Growth lines deeply sinuated on the constriction and gently flexed on the periphery. Altitude 20 mm.; latitude 7 mm.

Observations: Apical angle on topotypes 22°–24°. Distinguished from *T. perdita* Conrad by the depressions between the whorls and by the greater apical angle of the early whorls.

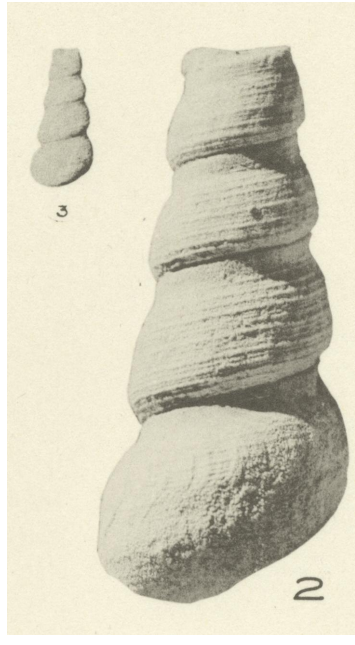


Fig. 3—type, X ¾, Plummer 1937.
Fig. 2—same, X 3.

Type Data: Lectotype, No. 5388, in Plummer collection, Bureau of Economic Geology, The University of Texas, Austin, Texas.

Type Locality: Quarry and creek approximately 1 mile south of Ola, eastern Kaufman County, Texas.

Geologic Horizon: Rocky Cedar Creek limestone lentil of the Kincaid formation, Midway group, Paleocene.

Distribution: Known only from type locality.

Synonymy:

1933 *Turritella kincaidensis* Plummer, F. B., Cenozoic systems in Texas, *in* The Geology of Texas: Univ. Texas Bull. 3232, p. 815, pl. 10, fig. 3; not fig. 3a = *Turritella plummeri* Stenzel & Turner.

1935 Gardner, J. A., The Midway group of Texas: Univ. Texas Bull. 3301, p. 285.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 320, 321.

1940 *Turritella kincaidensis*, Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 840, pl. 47, fig. 2.

Original Description: Apical angle 12.5°; sculpture consisting of 14 finely beaded lirae; shape of whorl convex with greatest diameter anterior.

Observations: Plummer's original description is a composite description of two different species. The apical angle of the lectotype is 17°; whorls inflated with maximum inflation one-fourth the height of the whorl from the anterior suture and with a pronounced concave constriction at the posterior suture.

Turritella plummeri Stenzel & Turner has a straight slope between the anterior and posterior angulation. *Turritella hilli* Gardner is angulated close to the anterior suture and has a whorl profile concave between the angulation and the posterior suture.

LEVICUNEA HARRIS

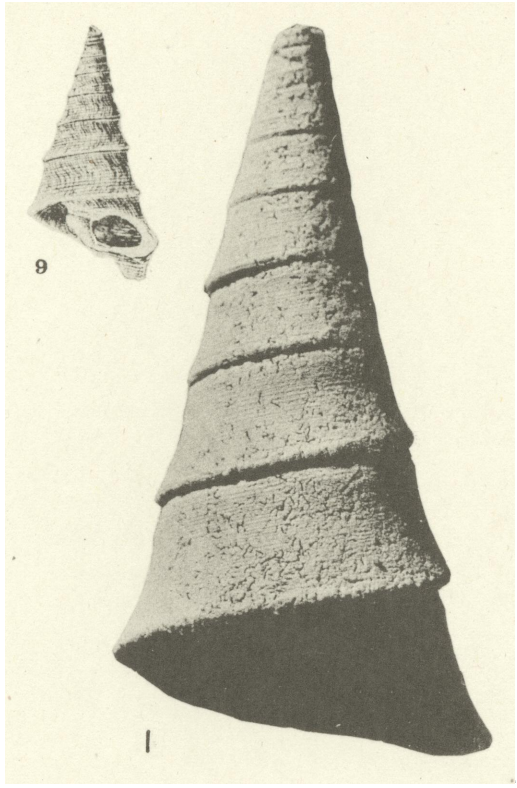


Fig. 9—holotype, Harris 1896.

Fig. 1—specimen, X 3, from State highway No. 96, 10.3 miles northeast of Kimbrough, Wilcox County, Alabama.

Type Data: Holotype No. 43, Paleontological Research Institution, Ithaca, New York.

Type Locality: Dale Branch above and below a waterfall known as the cave, approximately ½ mile north of Oakhill-Rosebud highway, north half sec. 17, T. 11 N., R. 10 E., Wilcox County, Alabama. Dale Branch heads 0.35 mile west of the road crossing at Oakhill directly at north edge of Rosebud-Oakhill highway.

Geologic Horizon: Naheola formation, Midway group, Paleocene.

Distribution: Naheola formation of Alabama. Reported by Bowles 1939 also from the Clayton formation of Alabama.

Synonymy:

1896 *Turritella mortoni* var. *levicunea* Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 224, pl. 21, fig. 9.

1933 Not Plummer, F. B., Cenozoic systems in Texas, *in* The Geology of Texas: Univ. Texas Bull. 3232, p. 815, pl. 10, figs. 4, 4a = *T. hilli* Gardner.

1939 *Turritella levicunea,* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 301.

Original Description: This variety differs from typical *T. mortoni* by its greater apical angle, its finer striation and the lack of a strong subcentral carina on the whorls.

Observations: This is a large species with whorls straight-sided or slightly concave and basal carina which is largely covered on the spire but very pronounced on the body whorl. Early whorls with 2 widely separated revolving threads; many fine threads introduced early in the space between the primaries; basal carina much nearer the anterior suture and less prominent on the spire than in *T. mortoni* Conrad.

Dimensions of holotype are: height of broken shell, 35 mm.; greatest diameter 17 mm.

Prepared by H. B. Stenzel & F. E. Turner, Bureau of Economic Geology, Austin, Texas.

DUTEXATA LISBONENSIS BOWLES

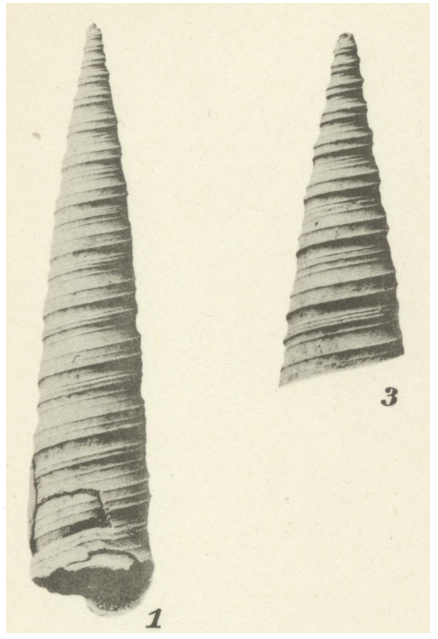


Fig. 1—holotype, X 2,
Fig. 3—paratype, X 3; Bowles 1939.

Type Data: Holotype No. 498009, and paratype No. 497952, U. S. Nat. Mus., Washington, D.C.

Type Locality: Bluff about 1 mile south of Lisbon Landing on right bank of Alabama River, Monroe County, Alabama.

Geologic Horizon: Lisbon formation, Claiborne group, middle Eocene.

Distribution: Lisbon formation of Alabama, Claiborne group, middle Eocene.

The distribution given for *T. lisbonensis* by Bowles 1939 appears to include typical *T. dutexata* Harris. *Turritella dutexata lisbonensis* has not been found by us among any Texas or Louisiana materials.

Observations: This species is closely related to *T. dutexata* Harris although it does not resemble it much on hasty inspection; *T. dutexata* has few ribs in the adult stage and lacks the secondary lirae, has a more convex whorl shape, and lacks the convex spire profile. A prominently convex spire profile is also characteristic of *T. arenicola* (Conrad) and *T. houstonia* Harris, which very much resembles *T. dutexata lisbonensis* in the adult stage. However, *T. houstonia* has the sutural collar and the convexity and the two concavities of the whorls so slight, that the whorl shape is almost straight. The adult rib pattern of *T. houstonia* is also very similar, but *T. houstonia* has finer and more numerous ribs than *T. dutexata lisbonensis.*

TURRITELLA

Synonymy:

1937 *Turritella nasuta,* Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 200, pl. 25, fig. 3 only.

1939 *Turritella lisbonensis* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 286–288, pl. 31, figs. 1, 3.

Original Description: Shell large. Spire high, gently tapering in the adult stage, more abruptly tapering in youth, the sharp change in the spire profile appearing at about the eighth or ninth whorl. Whorls wider than high, especially in the young stages, slightly rounded, separated by indistinct linear sutures. Apical whorls marked by two prominent, sharp, revolving lirae set very close together and situated much nearer the anterior than the posterior suture; a smaller secondary thread appearing on the third whorl between the primary cords and the posterior suture, remaining small throughout the growth of the shell; an additional fine revolving line appearing between the two primary lirae on the ninth whorl, and persisting through the adult stages; area between the anterior primary cords and the suture slightly constricted toward the suture, and marked only by fine revolving lines. Incrementals slightly arcuate, the maximum of the curvature being attained at about the posterior third of the whorl, very slightly recurved just above the suture. Aperture not well preserved; apparently rounded. Outer lip badly broken.

Dimensions: Holotype, height, 39.5 mm; greatest diameter, 8.5 mm.

Revised Description: Apical angle 20° juvenile, 8° adult; spire profile convex. First 2 or 3 apical whorls unknown, presumably smooth and convex; approximately the third apical whorl is unicarinate with the carina in the middle of the whorl. After one-half volution two faint lirae are added, one on the posterior the other on the anterior slope of the carina. Anterior accessory lira grows until on the tenth whorl it equals the primary carina in size; posterior accessory lira grows too, but does not reach the size of the others. On approximately the tenth to twelfth whorl are only 3 primary lirae of which the 2 anterior are prominent and equal. This stage is characteristic of this subspecies and similar to the same stage in *T. dutexata* Harris, but in the latter species the posterior primary weak lira is situated at or very near the posterior suture, while in *T. dutexata lisbonensis* it is a little more removed from that suture. Posterior primary lira gradually moves away from suture and space thus created is occupied by twin secondary lirae making a small sutural collar. Later 3 weak lirae are intercalated, one between anterior suture and anterior primary lira but nearer to the latter, one between the two anterior primary lirae, and one between the two posterior primary lirae. Fine threads develop between these ribs; some of the threads are slightly larger and alternate with the ribs. Fully grown adult whorls have fine threads alternating with 8 ribs as follows: twin ribs on posterior sutural collar, 2 weak ribs widely and symmetrically spaced in concave portion of whorl anterior to collar, 3 ribs on bulge of whorl with middle rib smaller, and one rib anterior of these. Whorl shape defined by posterior sutural collar, concave space anterior to the collar, bulge at the 2 anterior primary lirae, and excavated place adjoining the anterior suture.

PERDITA LOWEI COOKE

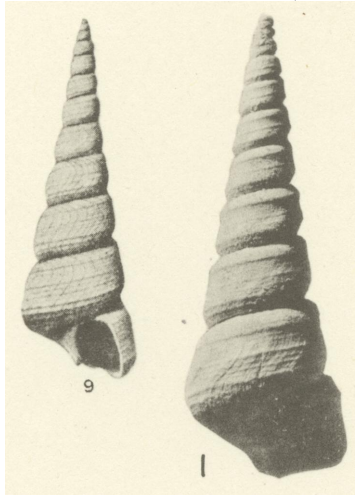


Fig. 9—holotype, X 2, Cooke 1926.
Fig. 1—topotype, X 3.

Type Data: Holotype No. 353945, U. S. Nat. Mus., Washington, D.C.

Type Locality: Moodys Branch, cliff on right bank of branch, near intersection of Peachtree Street and Poplar Boulevard, in northern part of Jackson, Hinds County, Mississippi.

Geologic Horizon: Moodys marl, Jackson group, upper Eocene.

Distribution: Moodys marl, Hinds County, Mississippi. Reported also from Garlands Creek, Clarke County, Mississippi (Bowles 1939).

Synonymy:

1926 *Turritella lowei* Cooke, C. W., New Eocene Mollusca from Jackson, Mississippi: Washington Acad. Sci. Jour., vol. 16, p. 136, fig. 9.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 321.

Original Description: Shell slender, apical angle 20°, becoming stouter with increasing growth. First 8 or 10 whorls nearly cylindrical or slightly constricted; later whorls flat. Suture deeply depressed; growth lines sigmoid. Sculpture of faint, spiral threads becoming more conspicuous on larger whorls; many young shells become almost smooth. One or two whorls broken from tip of type; twelve whorls remaining. Altitude 23 mm.; latitude 8 mm.

Observations: Apical angle of topotypes 20° at extreme tip, 12° for first 11 whorls; apical angle of holotype 20° over entire shell.

According to Bowles 1939, apical whorls smooth; very fine, indistinct revolving lines first appearing about the fifth whorl. Growth lines distinct but not prominent, slightly beading the fine posterior revolving lines, strongly arcuate, maximum curvature between posterior third and median of whorl.

Turritella lowei most closely resembles *T. perdita* and *T. perdita jacksonensis* and is probably only the end member of a continuous series differing from *T. perdita* by the smoothness of the early whorls and the depression of the suture and from *T. perdita jacksonensis* by the slenderness of the early whorls.

MARTINENSIS DALL

TURRITELLA

Fig. 10—lectotype X 1½, Bowles 1939.

Type Data: Lectotype, No. 498390, U. S. Nat. Mus., Washington, D.C.

Type Locality: Quarry at Martin station, Hernando County, Florida.

Geologic Horizon: Ocala limestone, Jackson group, upper Eocene.

Distribution:. Ocala limestone of Florida and Georgia and Barnwell formation of Georgia, all in Jackson group, upper Eocene.

Synonymy:

1892 *Turritella indenta* var. *martinensis* Dall, W. H., Contributions to the Tertiary Fauna of Florida, etc.: Wagner Free Inst. Sci. Trans., vol. 3, pt. 2, p. 308–309.

1915 *Turritella* var. *martinensis*, Cooke, C. W., The age of the Ocala limestone: U. S. Geol. Survey Prof. Paper 95, p. 111.

1939 *Turritella martinensis*, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 282, 283, pl. 31, fig. 10.

Original Description: Shell differing from the type [that is *T. indenta*] by the development of the marginal riblets a little farther from the suture, and their frequent duplication by a fainter thread; on the upper whorls the posterior thread is usually undulate or beaded, and sometimes both are so.

Observations (adapted from Bowles 1939): Whorls twice as wide as high, constricted medially, sharply delimited by the linear, distinct and not deeply impressed sutures. Apical whorls unknown; earliest whorls preserved with strong anterior and posterior revolving cords; interspace sculptured by finer secondary lines. Two accessory lirae develop in interspace gradually increasing in size until on adult whorls the sculpture consists of four subequal lirae arranged in pairs with a deeply excavated medial portion between. Growth lines deeply arcuate, maximum inflection medial or slightly posterior, slightly recurved just behind the suture, cutting the revolving threads and giving them a strongly beaded appearance.

Turritella martinensis differs from *T. perdita* Conrad, *T. subtilis* Kellum, *T. perdita lowei* Cooke, and *T. perdita jacksonensis* Cooke by the double carinas of the adult whorls; from *T. rivurbana* Cooke by the strong beading of the carinas.

Dimensions of lectotype: Height 35.0 mm., greatest diameter 12.5 mm.

McBEANENSIS BOWLES

TURRITELLA

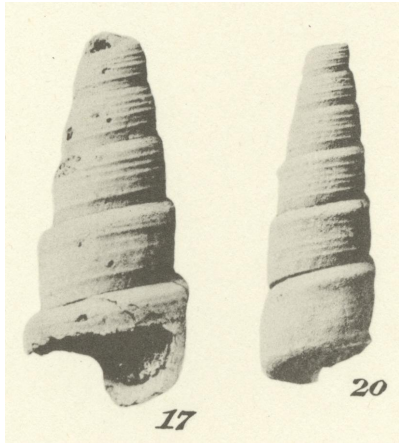


Fig. 17—paratype, X 3,
Fig. 20—holotype, X 2; Bowles 1939.

Type Data: Holotype No. 497956, paratype No. 497957, U. S. Nat. Mus., Washington, D.C.

Type Locality: Site of Stromans Mill, bluff east of Rocky Swamp on the road from Springfield to Norway, 4 to 5 miles east of Springfield, Orangeburg County, South Carolina. For discussions of this locality see Tuomey, Michael, Report on the geology of South Carolina, p. 151, 1848, and Cooke, C. W., Geology of the Coastal Plain of South Carolina: U. S. Geol. Survey Bull. 867, p. 61, 1936.

Geologic Horizon: McBean formation, Claiborne group, middle Eocene.

Distribution: Known only from type locality.

Synonymy:

1939 *Turritella mcbeanensis* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 319, pl. 32, figs. 17, 20.

Original Description: Shell small, heavy. Spire abruptly tapering in a series of steps formed by the overlapping of each whorl onto the preceding whorl. Whorls straight-sided, shouldered posteriorly; sutures linear but deeply impressed on the flat-topped upper surface of the prominent shoulders. Earliest apical whorls not preserved; first whorls present on the types exhibiting three rather strong subequal revolving lirae, equidistant from each other and symmetrically placed on the whorl; numerous inconspicuous secondary revolving threads, variously placed between the primaries and between them and the sutures; some of the secondaries rapidly increasing in size until the adult whorls are marked by five or six subequal, but not prominent, revolving cords. Incrementals indistinct, deeply arcuate, the maximum curvature attained at about the posterior third of the whorl, very slightly recurved at the anterior suture. Aperture not preserved entire.

Dimensions: Holotype, height, 22.0 mm; greatest diameter, 7.5 mm. Paratype, height, 17 mm; greatest diameter, 7.2 mm. Both the types are broken at the aperture and the apex.

Observations (Bowles 1939): Turritella mcbeanensis is extremely reminiscent of the Midway and Wilcox members of the *Turritella humerosa* group. It most closely resembles *T. biboraensis* and *T. claytonensis* of the Midway, but it differs from them in the three strong revolving carinae, both the older species being marked by numerous fine subequal revolving lines. The angle of the spire is much less than that of *T. claytonensis*.

MORTONI MEDIAVIA BOWLES

TURRITELLA

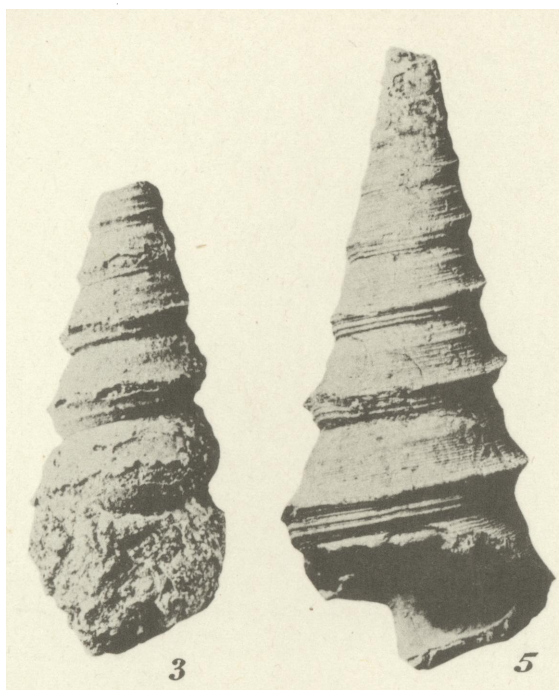


Fig. 3—paratype, X 1,
Fig. 5—holotype, X 2; Bowles 1939.

Type Data: Holotype No. 495146, paratype No. 497988, U. S. Nat. Mus., Washington, D.C.

Type Locality: Prairie Creek, about 3 miles north of Oakhill, Wilcox County, Alabama. Paratype from 3.5 miles west of Pinewood, Sumter County, South Carolina.

Geologic Horizon: Clayton formation, Midway group, Paleocene.

Distribution: Clayton formation of Alabama and Georgia and Black Mingo formation of South Carolina, both in Midway group, Paleocene.

Synonymy:

1894 *Turritella mortoni* var. Harris, G. D., The Tertiary geology of southern Arkansas: Arkansas Geol. Survey, Ann. Rept. for 1892, vol. 2, p. 48, pl. 3, fig. 5(?).

1896 *Turritella saffordi,* Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 224, pl. 21, fig. 8(?) cited in plate description as *T. mortoni* var.

1939 *Turritella mortoni mediavia* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 294, 295, pl. 33, figs. 3, 5.

Original Description: Spire abruptly tapering for the genus. Apical whorls sharply angulated anteriorly, concave in profile; adult whorls more rounded, almost convex in profile, sharply constricted at the sutures, which are linear but distinctly impressed between the apical whorls, gradually becoming deeper and wider between the later whorls. Sculpture of apical whorls consisting of a strong basal carina with a less prominent revolving cord near the posterior suture; both the carina and the posterior cord persistent on the adult whorls, the posterior giving the whorls a more rounded appearance than is general in the group. Secondary sculpture consisting of numerous very fine revolving lines, beaded on some of the early whorls by the intersection of the growth lines. Incremental striae distinct and sharply flexed medially, curving out again and then slightly reflexed at the anterior suture. Aperture unknown.

Dimensions: Holotype, height, 41.0 mm; greatest diameter, 19.0 mm; paratype, height, 44.0 mm; greatest diameter, 25.0 mm. Both specimens are incomplete, broken at the apex and the aperture.

Observations: Turritella mortoni mediavia differs from *T. mortoni* Conrad and the subspecies *postmortoni* Harris in the persistence of the fairly strong secondary carina that makes the whorls fuller than in either of the Wilcox forms.

MINGOENSIS BOWLES

Fig. 10—holotype, X 2, Bowles 1939.

Type Data: Holotype No. 497953, U. S. Nat. Mus., Washington, D.C.

Type Locality: Bend in the county line road from Georgetown to Rhems at the boundary line between Georgetown and Williamsburg counties, 1.2 miles south of Rhems and 3 miles northwest of Upper Browns Ferry, Georgetown County, South Carolina.

Geologic Horizon: Black Mingo formation. Midway group, Paleocene. The fossil was found in a 10-foot bed of reddish cross-bedded sand and gravel passing upward into fine brick-red sand overlying 6 feet of brittle gray shale. Compare Cooke, C. W., Geology of the Coastal Plain of South Carolina: U. S. Geol. Survey Bull. 867, p. 44, 1936.

Distribution: Known only from Black Mingo formation of South Carolina.

Synonymy:

1939 *Turritella mingoensis* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 319, 320, pl. 32, fig. 10.

Original Description: Spire high, very slender, 11 whorls in the holotype. First three apical whorls bare, a distinct medial carina appearing on the fourth whorl; anterior to the primary carina the whorls are distinctly convex, but posterior to this carina they are smooth and concave in the apical region; a small indistinct carina appearing near the posterior suture at about the sixth whorl, never attaining a size comparable to that of the anterior carina but persisting to the body whorl; a small revolving line developed on the fifth whorl anterior to the primary carina, increasing with the growth of the shell and augmented by other indistinct revolving cords until on the body whorl there are five distinct lirae; very faint revolving lines appearing on the adult whorls posterior to the primary carina in some specimens, but on the type this area is bare except for the one posterior lira. Incrementals very faintly marked but indicating a strong sinuosity of the outer lip, the maximum retraction of the sinus situated a little behind the median of the whorl. Aperture not preserved entire on any of the specimens observed.

Dimensions: Holotype, height, 24.0 mm; greatest diameter, 6.2 mm.

Observations (Bowles 1939): The slender form of this species, with the lower half of the whorls marked by revolving lines and convex, though the upper half is practically bare and concave, distinguish *Turritella mingoensis* from the other Gulf and Atlantic Eocene Turritellas. What the relationship of this unique species may be is uncertain, but it seems to have closer affinities with the group of *T. mortoni* than with the *T. humerosa* stock.

MISSISSIPPIENSIS CONRAD

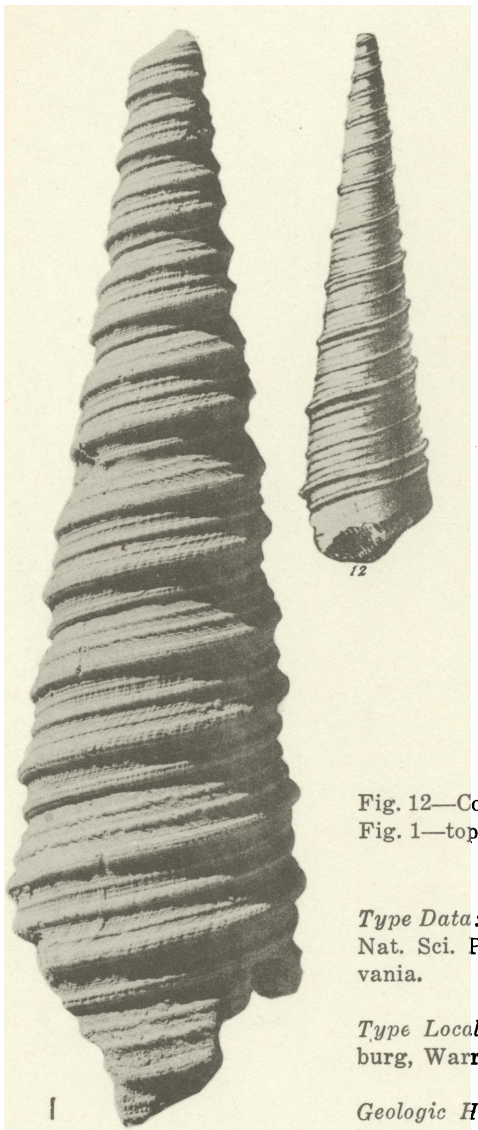


Fig. 12—Conrad 1848.
Fig. 1—topotype, X 3.

Type Data: Unknown, presumably in the Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania.

Type Locality: Bluffs along creeks in Vicksburg, Warren County, Mississippi.

Geologic Horizon: Mint Spring marl, Vicksburg group, Oligocene.

Distribution: Mint Spring marl of Mississippi.

Synonymy:

1848 *Turritella mississippiensis* Conrad, T. A., Observations on the Eocene formation, and descriptions of one hundred and five new fossils of that period, from the vicinity of Vicksburg, Mississippi, with an Appendix: Acad. Nat. Sci. Philadelphia Proc., vol. 3, p. 283.

1848 Conrad, T. A., Observations on the Eocene formation, and descriptions of one hundred and five new fossils of that period, from the vicinity of Vicksburg, Mississippi; with an Appendix: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 1, pt. 2, p. 114, pl. 11 (not 12), fig. 12.

Original Description: Subulate, volutions flattened, with seven revolving lines on the larger ones, the penultimate line large and prominent; longitudinal wrinkles fine, approximate, much curved, crenulating the revolving lines; the whorls near the apex generally with two prominent distant revolving lines, and a less prominent one margins the suture. Length 3 inches. Not abundant.

Observations: Earliest whorls observed have 2 prominent revolving lirae and a fainter median lira. Adult whorls with 2 marked primary carinae, a secondary carina between them, a tertiary thread between the secondary and each of the primary ribs, and 2 tertiary threads posterior to the posterior primary. An eighth rib develops immediately posterior to the suture. Growth lines with maximum inflection between median secondary and posterior primary rib.

MONROENSIS MANSFIELD

Fig. 59—holotype, X 1, Mansfield 1940.

Type Data: Holotype No. 498478, U. S. Nat. Mus., Washington, D.C.

Type Locality: From lower part of Chickasawhay marl at station 14205a, overlying limestone in gully about ¼ mile north of Perdue Hill, Monroe County, Alabama.

Geologic Horizon: Lower part of Chickasawhay marl, Oligocene.

Distribution: Lower part of Chickasawhay marl in Alabama; Chione limestone of lower part of Chickasawhay marl in Mississippi.

Synonymy:

1940 *Turritella monroensis* Mansfield, W. C., Mollusks of the Chickasawhay marl: Jour. Paleontology, vol. 14, p. 219–220, pl. 27, fig. 59.

Original Description: Shell large, slender, the apical angle between 15° and 20°, and the number of whorls probably between 15 and 20. Nuclear whorls and earliest postnuclear whorls lost. On earliest of the retained whorls a single strong basal cord, and in front of the posterior suture a sharp thread; and between the posterior thread and the anterior cord a concave medial area; a second basal cord emerging behind the anterior suture, and a second thread in front of the posterior suture, becoming in late adolescence equal in prominence to the original cord and thread with which they are paired; a fine sharp threadlet developed later on the strongly concave interarea but closer to the posterior pair of spirals than to the anterior pair; basal spirals apparently overrun with fine secondary threadlets, though the condition of preservation of the material obscures this character. Suture lines distinct and later whorls undercut. Characters of aperture lost, the body whorl doubtfully retained on a single individual; spiral sculpture on body possibly becoming obsolete, but the incrementals greatly strengthened; sinus as indicated by the growth lines deep, its axis co-incident with the concave area between the anterior and posterior pairs of spirals.

Dimensions: Holotype, height, 68 mm., diameter, 17 mm.

Original Remarks: Turritella monroensis recalls *T. halensis* Dall (1916) from the Flint River formation at Hale's Landing, Flint River, Ga. It is a more slender shell, however, than the Flint River species and differs in the detail of the sculpture pattern. In *T. halensis*, the anterior of the two basal cords is less prominent than that behind it, there is a single posterior primary, but several secondaries are intercalated between the primary and the posterior suture and on the shallow concave medial area between the anterior and posterior primaries. However, by slight modifications in the relative prominence of the posterior and the anterior spirals, and the introduction of additional secondaries, *T. monroensis* approaches very closely to *T. halensis*, and it is possible that the forms are only subspecifically distinct. Both *T. halensis* and *T. monroensis* may be in the line of descent from *T. martinensis* Dall of the Ocala limestone in Florida, and may belong to the group which includes *T. mississippiensis* Conrad from the Byram marl at Vicksburg. In sculpture pattern, the Vicksburg species more closely resembles *T. halensis* and lacks the characteristic paired anterior spirals of *T. monroensis*.

The species is known only from external molds.

MORTONI CONRAD

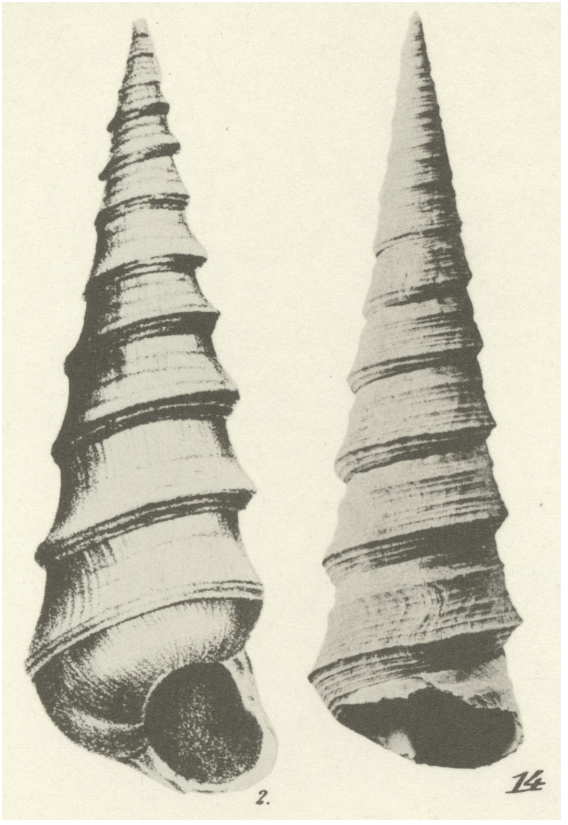


Fig. 2—Conrad 1830.

Fig. 14—specimen from Fairview Beach, Stafford County, Virginia, Bowles 1939.

Type Data: A lectotype and 4 paratypes, Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania. Figured specimen, Bowles 1939, No. 497990, U. S. Nat. Mus., Washington, D.C.

Type Locality: Piscataway, Prince Georges County, Maryland.

Geologic Horizon: Aquia formation, Wilcox group, lower Eocene.

Distribution: Aquia formation of Maryland and Virginia.

Synonymy:

1830 *Turritella mortoni* Conrad, T. A., On the geology and organic remains of a part of the Peninsula of Maryland: Acad. Nat. Sci. Philadelphia Jour., ser. 1, vol. 6, p. 221, pl. 10, fig. 2.

1835 Not *T. mortoni* var.*A* Conrad, T. A., Fossil shells of the Tertiary formations of North America [republication], p. 40, pl. 15, fig. 11 = *T. carinata* Isaac Lea.

1890 *T. mortoni*, de Gregorio, A., Monographie de la faune éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 122, 123, pl. 11, fig. 7; not pl. 11, figs. 3–6, 9 = *T. carinata* Isaac Lea.

1894 Harris, G. D., On the geological position of the Eocene deposits of Maryland and Virginia: Am. Jour. Sci., ser. 3, vol. 47, p. 302, 303, text fig. 3.

1896 Clark, W. B., The Eocene deposits of the middle Atlantic slope in Delaware, Maryland, and Virginia: U. S. Geol. Survey Bull. 141, p. 69, 70, pl. 13, figs. 1a–1e.

1899 Not Harris, G. D., The Lignitic stage: Bull. Am. Paleontology, vol. 3, p. 74, 75, pl. 10, figs. 3, 4 = *T. mortoni postmortoni* Harris.

1899 Not Harris, G. D., Preliminary report on the geology of Louisiana: Louisiana Geol. Survey, Rept. for 1899, p. 299, 308, pl. 52, fig. 9, pl. 55, fig. 4 = *T. mortoni postmortoni* Harris.

1901 *Turritella mortoni* + *postmortoni*, Clark, W. B., & Martin, G. C., Systematic paleontology, Eocene, Mollusca: Maryland Geol. Survey, Eocene, p. 147, 148, pl. 26, figs. 1–5.

1926 Not *T. mortoni*, Cooke, C. W., The Cenozoic formations, *in* Geology of Alabama: Alabama Geol. Survey, Special Rept. 14, pl. 94, fig. 2 = *Turritella mortoni postmortoni* Harris.

1939 *Turritella mortoni*, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 293, 294, pl. 33, fig. 14.

Original Description: Shell turreted, conical, thick, with revolving distant, and finer intervening striae; whorls with an elevated acute carina near the base of each; volutions about eleven; the striae are largest on the elevations of the whorls, which are slightly concave above, and abruptly terminate at the sutures; the lines of growth on the last whorl are strong and much undulated.

Observations: Apical whorls marked by 3 distinct revolving lirae, the anterior becoming relatively much the strongest with the growth of the shell and forming a distinct carina on the seventh or eighth whorl. A secondary lira appears on the fourth whorl between the two posterior primary lirae; additional lirae variously placed appear during the growth of the shell until there are 10 or 11 subequal lirae between the anterior carina and the posterior suture. Under-surface of carina at first smooth; a lira appears on about the eleventh whorl with others following in quick succession until on the last whorl there may be four large lirae with 2 or 3 indistinct threads between them. Growth lines strongly flexed at about the posterior third of the whorl.

Turritella mortoni postmortoni Harris has less prominent adult sculpture and generally sharper carina. Bowles 1939 believed *T. potomacensis* Clark & Martin to be a descendant of the *T. humerosa* Conrad stock rather than of *T. mortoni* because of its multicostate instead of tricostate early whorls.

MULTILIRA WHITFIELD

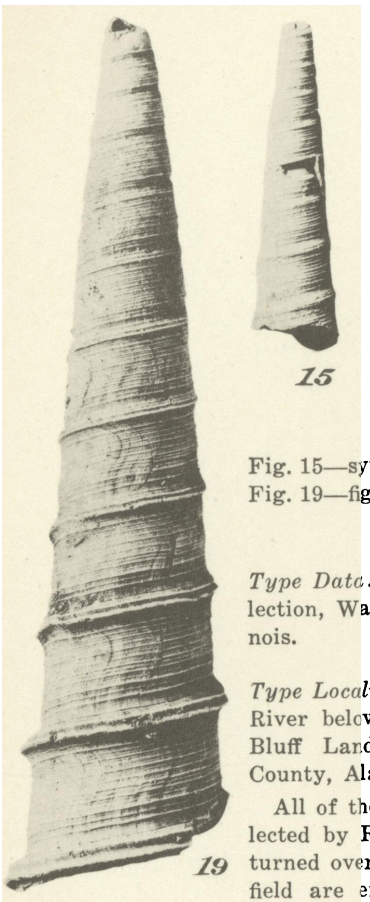


Fig. 15—syntype, X 1, figured by Bowles 1939,
Fig. 19—figured specimen, X 2, Bowles 1939.

Type Data: Several syntypes No. 24521, James Hall collection, Walker Museum, Univ. of Chicago, Chicago, Illinois.

Type Locality: Presumably one of the bluffs on Alabama River below mouth of Pursley Creek and above Yellow Bluff Landing, east of Yellow Bluff Station, Wilcox County, Alabama.

All of the species described by Whitfield 1865 were collected by Reverend T. J. Hale of Mobile, Alabama, and turned over to James Hall. The localities given by Whitfield are erroneous (compare Aldrich, T. H., Notes on Tertiary fossils, with descriptions of new species: Cincinnati Soc. Nat. History Jour., vol. 10, p. 79, 1887). All Alabama species described by Whitfield whose type locality can be fixed came from bluffs along Alabama River. Therefore, this species also was presumably collected on Alabama River.

Geologic Horizon: Probably Nanafalia formation, Wilcox group, lower Eocene (see Bowles 1939, p. 317, 327, 328).

Distribution: Nanafalia formation of Alabama. Reported by Bowles 1939 also from Nuevo León, Mexico.

Synonymy:

1865 *Turritella multilira* Whitfield, R. P., Descriptions of new species of Eocene fossils: Am. Jour. Conchology, vol. 1, p. 266.

1899 Harris, G. D., The Lignitic stage: Bull. Am. Paleontology, vol. 3, p. 75, pl. 10, fig. 6.

1926 *Turritella humerosa* var., Cooke, C. W., The Cenozoic formations, *in* Geology of Alabama: Alabama Geol. Survey, Special Rept. 14, pl. 94, fig. 1.

1939 *Turritella multilira*, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 316, 317, pl. 32, fig. 15, pl. 34, fig. 19.

Original Description: Shell of moderate size, extremely elongate, slender; volutions numerous (number unknown), quadrangular, flattened on the surface; upper margin elevated above the preceding volution; aperture rounded; surface marked by numerous very fine but distinct revolving striae, crossed by finer lines of growth, having a deep retral curve.

This species bears some resemblance to *T. quadristriata*, Rodgers, except in the surface markings.

Observations: Earliest known whorls marked by 7 or 8 fine revolving lirae, additional fine lines continuously added until there are 20 or more on the body whorl; 2 prominent posterior lirae mark a distinct posterior subsutural carina.

This species is distinguished from *Turritella bellifera* Aldrich by its fine spiral threads, sharper but less prominent subsutural carina, and less strongly marked growth lines.

NASUTA GABB

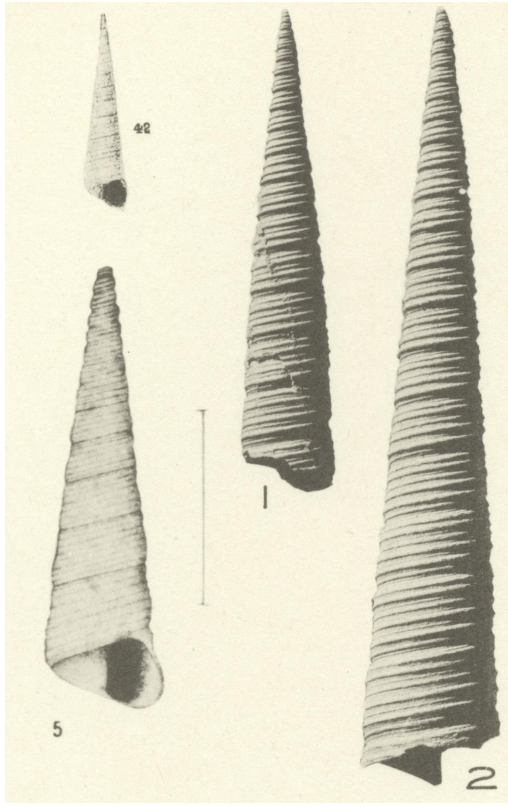


Fig. 42—Gabb 1860.
Fig. 5—Otto Meyer's drawing of Gabb's type.
Figs. 1, 2—topotypes, X 3.

Type Data: A lectotype and 5 paratypes, No. 13293, Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania. Figured topotype in Bureau of Economic Geology, The University of Texas, Austin, Texas.

Type Locality: Probably Stone City (Moseleys Ferry), bluff on right bank of Brazos River at bridge of State highway 21 and bridge of Southern Pacific Railroad, Burleson County, Texas.

Geologic Horizon: Stone City formation, Claiborne group, middle Eocene.

Distribution: Cook Mountain and Stone City formations of Texas. Reported also from Mexico and Louisiana.

Synonymy:

1860 *Turritella nasuta* Gabb, W. M., Descriptions of new species of American Tertiary and Cretaceous fossils: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 4, p. 385, pl. 67, fig. 42.

1937 Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 200, pl. 83, fig. 5; not pl. 25, figs. 1–3, 5, 6, 8–10.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 288, 289, pl. 32, figs. 5, 6.

Original Description: Shell elongated, slender; whorls many (number? eleven in one inch); mouth small, suture distinct; surface marked by eight revolving lines, two or three of which are larger than the rest.

Dimensions of a specimen one inch long.—Width of body whorl ·2 in., length of mouth ·15 in.

All the specimens I have seen are broken and nearly all worn smooth. It is common.

Locality.—Caldwell Co., Texas, and Wheelock.

Observations: Apical angle 13° juvenile, 6½° adult; spire profile convex near apex. First 2 apical whorls convex and smooth; next half volution unicarinate with the carina anterior to the middle of the whorl; a second primary carina is added posterior to the first at approximately 2½ volutions; the second carina reaches very soon the same size as the first; on the third whorl appears another primary posterior to the two early primaries; the posterior primary remains weaker for several whorls but reaches the other two in strength at about the eighth whorl. A fine secondary lira appearing on the ninth to fourteenth whorl between the posterior primary and the suture and another between the anterior primary and the suture; others appear between the posterior primary and the suture and between the posterior and middle primary, so that finally there are usually 7 unequal spirals on the adult whorls with finer striations in between. Whorls usually flat-sided, rarely with very slight inflation; suture linear, distinct.

Turritella nasuta felli Bowles attains a greater size and in some specimens a coarser sculpture. It is apparently only a geographic group differing only slightly from typical *T. nasuta.*

Turritella nasuta smithvillensis Bowles is a stratigraphic variant with whorls more commonly slightly inflated, an apical angle of the adult whorls as small as 5°, and primaries beaded in juvenile and early adult stage.

OBRUTA CONRAD

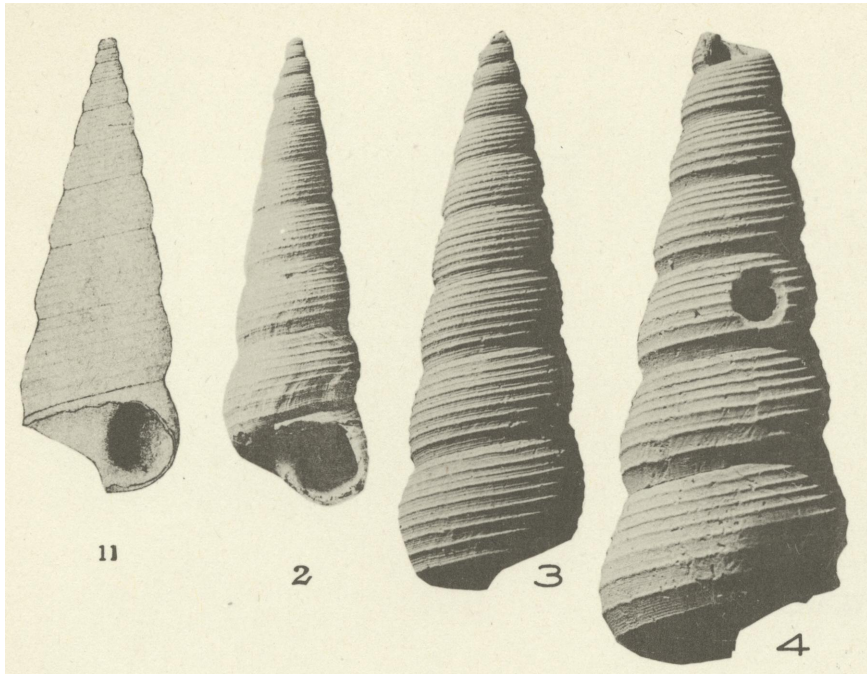


Fig. 11—Otto Meyer's drawing of Conrad's syntype as published by Palmer 1937.

Fig. 2—topotype, X 2, Bowles 1939.

Figs. 3, 4—topotypes, X 3.

Type Data: A lectotype and 6 paratypes in Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania. A holotype No. 5668 and a paratype No. 5669 of *T. lineata* Lea also in the Academy.

Type Locality: Claiborne Bluff, left bank of Alabama River, Monroe County, Alabama.

Geologic Horizon: Gosport sand, Claiborne group, middle Eocene.

Distribution: Gosport sand of Alabama.

Synonymy:

1833 *Turritella obruta* Conrad, T. A., Fossil shells of the Tertiary formations of North America, p. 45.

1833 *Turritella lineata* Lea, Isaac, Contributions to geology, Philadelphia, p. 130, pl. 4, fig. 121.

1835 Conrad, T. A., [republication of Conrad 1833], p. 40, pl. 15, fig. 12.

1890 *Turritella vittata* var. *abruta*, De Gregorio, A., Monographie de la faune éocénique de l'Alabama et surtout de celle de Claiborne de l'etage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 124, pl. 11, figs. 11, 25.

1937 *Turritella obruta*, Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 203, pl. 26, figs. 12–14, pl. 82, fig. 11.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 311, pl. 33, fig. 2.

Original Description: Subulate, with about eleven slightly convex volutions, with about seven sharp elevated striae on each, and intermediate fine crowded lines; space about the suture indented.

Observations: Apical angle juvenile 24°, adult 15°–17°. Shell profile convex; whorls convex; sutures impressed; apical whorls marked by 3 to 5 subequal distinct but not prominent revolving lirae. Fine secondary lirae arise on the third and later whorls; 2 to 6 of them increase in strength until approximately equal to the primaries, giving adult whorls from 7 to 11 well marked revolving ribs; interspaces filled with finer lirae and striae. Growth lines deeply flexed with maximum inflection between the median and posterior third of the whorl.

This is the only species of *Turritella* from the Gosport sand which has many fine spirals on the apical whorls. *Turritella pleboides* Vaughan is more slender and has more deeply sunken sutures.

Associated with *T. obruta* in the Gosport sand are specimens with bilirate early whorls and adult sculpture very similar to it. We hesitate to describe these specimens as a new species because one of them develops a third rib very early between the two primary lirae and suggests the possibility that there may be an intergradation between *T. obruta* with the multilirate early whorls and the bilirate form which is as yet unnamed. A specimen of this kind was figured under the name of *T. dutexata*, Palmer, K. Van W. 1939, pl. 26, fig. 1.

OLA PLUMMER

TURRITELLA

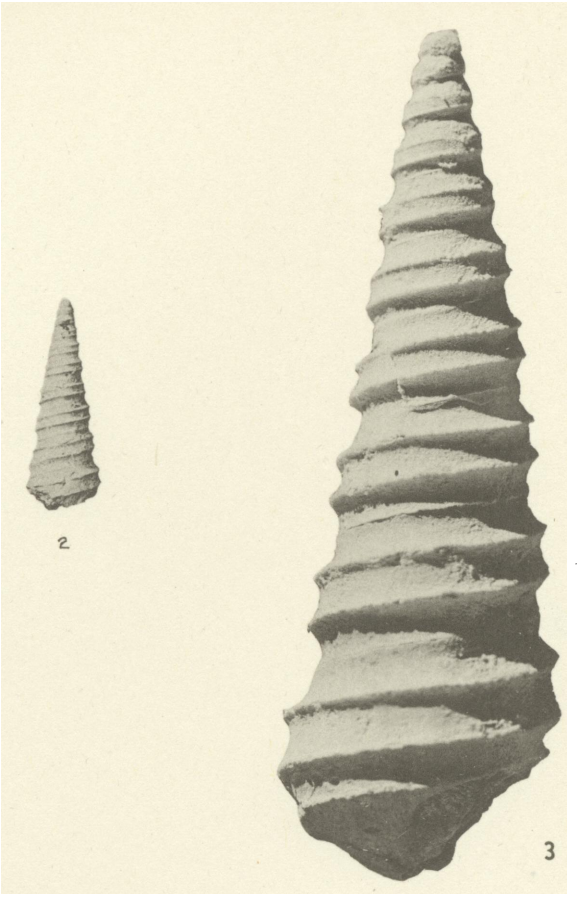


Fig. 2—holotype, X 4/5, Plummer 1933,
Fig. 3—holotype, X 3, Stenzel & Turner 1940.

Type Data: Holotype, No. 5387, in Plummer collection, Bureau of Economic Geology, The University of Texas, Austin, Texas.

Type Locality: Quarry and creek approximately 1 mile south of Ola, eastern Kaufman County, Texas.

Geologic Horizon: Rocky Cedar Creek limestone lentil of Kincaid formation, Midway group, Paleocene.

Distribution: Known only from type locality.

Synonymy:

1933 *Turritella ola* Plummer, F. B., Cenozoic systems in Texas, *in* The Geology of Texas: Univ. Texas Bull. 3232, p. 815, pl. 10, fig. 2.

1935 Gardner, J. A., The Midway group of Texas: Univ. Texas Bull. 3301, p. 291.

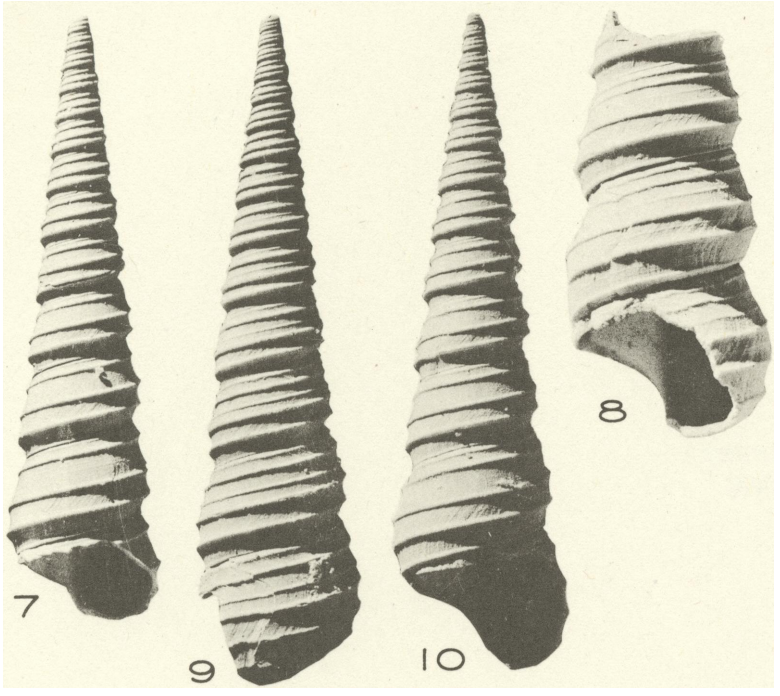
1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 320, 321.

1940 Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 834, 835, pl. 46, fig. 3.

Original Description: Apical angle 18°, sculpture consisting of 2 narrow high spirals and faint posterior spiral line, whorls separated by a fine nearly invisible lira.

Observations: Apical angle is 20° instead of 18°. A spiral rib separates the base from the sides of the body whorl; this rib is almost entirely covered on the spire and is the nearly invisible lira referred to by Plummer. This species is very similar to *T. dutexata* Harris but has an apical angle 2°–3° greater and maximum inflection of growth lines on or anterior to posterior spiral line instead of posterior to it.

FEMINA OLIGOPLOKA STENZEL



Figs. 7–10—syntypes, X 3, Stenzel & Turner 1940.

Type Data: Numerous syntypes in Stenzel collection, Austin, Texas.

Type Locality: North ditch of Concord-Centerville county road, 0.6 mile southeast of Robbins crossroads, in south corner of J. M. Powell 100-acre tract, in south corner of R. M. Tyus survey, Leon County, Texas; Bureau of Economic Geology locality No. 145–T–1; compare H. B. Stenzel, The Geology of Leon County, Texas: Univ. Texas Pub. 3818, 1939.

Geologic Horizon: Viesca member, Weches formation, Claiborne group, middle Eocene.

Distribution: Weches formation of east Texas.

Synonymy:

1940 *Turritella femina oligoploka* Stenzel *in* Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 832, pl. 46, figs. 7–10.

Original Description: Apical angle 20° juvenile, 12° adult; spire profile convex. Adult whorls with 3 equal spiral ribs of which the two anterior ones are a little closer together; these 3 spiral ribs are the primaries; late in the adult stage a fourth rib develops out of and remains near the posterior suture; in old age the whorls become a little loosely coiled; through this loose coiling a rib is bared at the anterior suture; normally this rib marks the edge of the body whorl base; early in the adult stage of many specimens a secondary spiral appears between the 2 posterior primary spirals. Adult whorl shape convex, but not inflated.

Observations: This subspecies is represented by numerous specimens at the type locality, but there are a few specimens which are transitional to typical *T. femina* Stenzel. Therefore, *T. femina oligoploka* and *T. femina* are end members of a series.

The subspecies has essentially the same rib pattern as *T. femina*, but it has fewer ribs, a slenderer spire, a convex spire profile, and a less inflated whorl shape. In general appearance *T. femina oligoploka* resembles *T. dutexata* Harris, with which it has been confounded. In *T. dutexata* there are two primary spirals which are prominent in the juvenile and adult stages; also its whorls are broader and lower in comparison with those of *T. femina oligoploka.*

The subspecific name is derived from the Greek ὀλίγος, few, and πλόκος, braid, and refers to the ribbing of the species.

CARINATA PALMERAE BOWLES

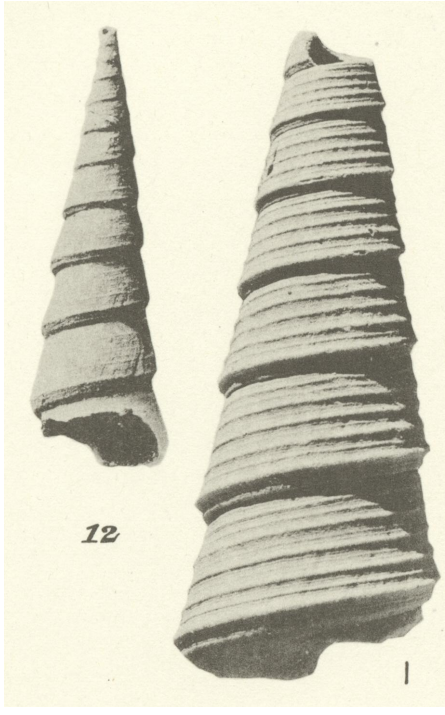


Fig. 12—holotype, X 2, Bowles 1939.
Fig. 1—topotype, X 3.

Type Data: Holotype No. 497997, U. S. Nat. Mus., Washington, D.C.

Type Locality: Bluff about one mile south of Lisbon landing on right bank of Alabama River, Monroe County, Alabama. Bed No. 6 of section in Smith, E. A., & others, Report on the geology of the Coastal Plain of Alabama: Alabama Geol. Survey, p. 130, 1894.

Geologic Horizon: Lisbon formation, Claiborne group, middle Eocene.

Distribution: Confined to Claiborne group, middle Eocene, of eastern Gulf region; McBean formation of South Carolina, Lisbon formation of Alabama. Reported by Bowles 1939 also from Wautubbee formation of Mississippi and Cook Mountain formation of Louisiana.

Synonymy:

1937 *Turritella mortoni turneri,* Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 194, pl. 23, figs. 3, 7 only.

1939 *T. carinata palmerae* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 305, 306, pl. 33, fig. 12.

Original Description: Turritella carinata palmerae differs from typical *T. carinata* in its rounded and less variable basal carination. The apical sculpture of the two forms is identical, but on the subspecies *palmerae* the revolving lirae persist onto the adult whorls with much greater prominence than they do on the typical form.

Dimensions: Holotype; height, 29.0 mm; greatest diameter, 9.5 mm.

Observations: Apical angle is 18° to 19°. *Turritella turneri* Plummer from Texas is much smaller and has more numerous revolving lirae and a more rounded basal carina. These two species are not near related.

Prepared by H. B. Stenzel & F. E. Turner, Bureau of Economic Geology, Austin, Texas.

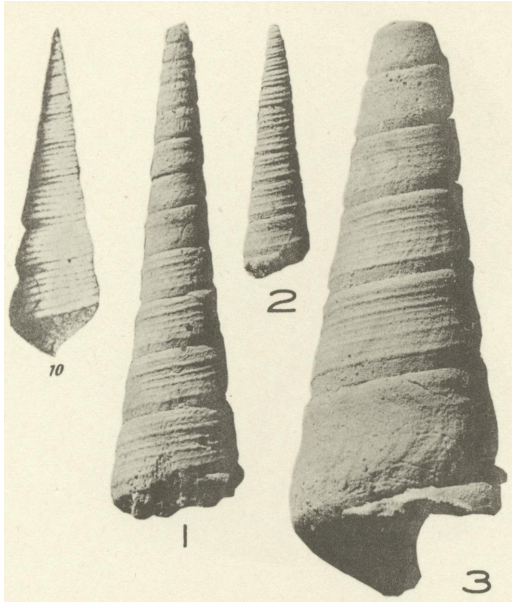


Fig. 10—Conrad 1865.
Figs. 1–3—topotypes, X 3.

Type Data: A lectotype and 2 paratypes, No. 13233, Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania. The above figured topotypes in Bureau of Economic Geology, The University of Texas, Austin, Texas.

Type Locality: Garlands Creek, bluff on south bank of creek, 0.2 mile east of the bridge and about 3.5 miles northeast of Shubuta (airline distance); northeast corner sec. 28, T. 1 N., R. 16 E., Clarke County, Mississippi.

Mistakenly given as Enterprise, Mississippi, by Conrad (see Aldrich, T. H., Observations on the Tertiary of Alabama: Am. Jour. Sci., 3d ser., vol. 30, p. 307, 1885).

Geologic Horizon: Moodys marl, Jackson group, upper Eocene.

Distribution: Moodys marl, Jackson group, Mississippi. Also reported from a well in Rapides Parish, Louisiana (Bowles 1939).

Synonymy:

1865 *Turritella perdita* Conrad, T. A., Descriptions of new Eocene shells from Enterprise, Mississippi: Am. Jour. Conchology, vol. 1, p. 141, pl. 10, fig. 10.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 307, 308; not pl. 32, fig. 11 = *T. jacksonensis* Cooke.

Original Description: Broad at base; volutions thirteen or fourteen, laterally flattened, and having five prominent revolving lines on each, with an intermediate fine line; the two inferior volutions of the spire slightly projecting near the base; body volution angulated; base finely striated; lines on the volutions, towards the apex, crenulated.

Observations (modified from Bowles 1939): Apical whorls slender with apical angle of 13°, protoconch smooth; three revolving lines appear on about the third whorl; secondary lirae develop on fourth and later whorls; occasionally secondaries assume a size equal to that of the primaries marking the adult whorls with 5 or 6 subequal lirae. Strength of sculpture variable, occasionally beaded. Greatest diameter of whorl is through anterior primary lira giving the shell a slight angulation at the base; base of body whorl marked by numerous indistinct, subequal fine revolving lines. Growth lines distinct, strongly arcuate, maximum inflection a little behind the median of the whorl, reflexed slightly just behind the suture. Profile of whorls and spire slightly concave.

Turritella alveata Conrad is distinguished by stronger spiral ribbing and straight profiles of whorls and spire; *T. perdita lowei* Cooke has smoother early whorls and deeper sutures; *T. perdita jacksonensis* Cooke has a greater apical angle and deep sutures. For further comparisons see observations under *Turritella rina* Palmer.

PERDUENSIS MANSFIELD

TURRITELLA

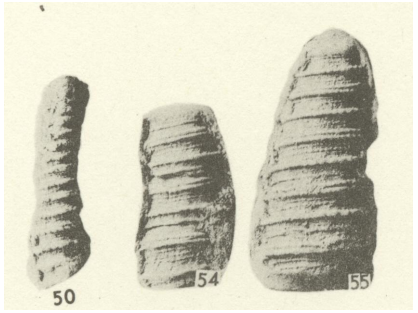


Fig. 50—syntype, juvenile, X 2,
Fig. 54—syntype, 3 adult whorls, X 1,
Fig. 55—syntype, 4 adult whorls, X 1½; Mansfield 1940.

Type Data: Three syntypes, Nos. 498481 (fig. 50), 498483 (fig. 54), and 498482 (fig. 55), in U. S. Nat. Mus., Washington, D.C.

Type Locality: Station 10334, ¼ mile northeast of Perdue Hill, Monroe County, Alabama.

Geologic Horizon: Lower part of Chickasawhay marl, Oligocene.

Distribution: Lower part of Chickasawhay marl, Oligocene, in vicinity of Perdue Hill, Alabama.

Synonymy:

1940 *Turritella perduensis* Mansfield, W. C., Mollusks of the Chickasawhay marl: Jour. Paleontology, vol. 14, p. 220–221, pl. 27, figs. 50, 54, 55.

Original Description: Shell of only moderate dimensions, slender, the apical angle between 15° and 20°. Whorls many, the number indeterminate, separated by distinct sutures. Nuclear and earliest postnuclear whorls lost. Earliest remaining whorls sculptured with two subequal beaded spirals, the one anterior, the other posterior, and between them a deep equatorial area, threaded with three or four finely beaded lirae; later sculpture modified by the introduction of a second posterior spiral behind the original, which within a few whorls equals the first in prominence and like it is rather strongly beaded; at a later growth stage a second anterior spiral emerges from behind the suture line, and additional secondaries are introduced. Characters of aperture not preserved.

Dimensions: Juvenile syntype, No. 498481 (fig. 50), height 14 mm. Syntype with three whorls, No. 498483 (fig. 54), height 20 mm., diameter 10 mm.

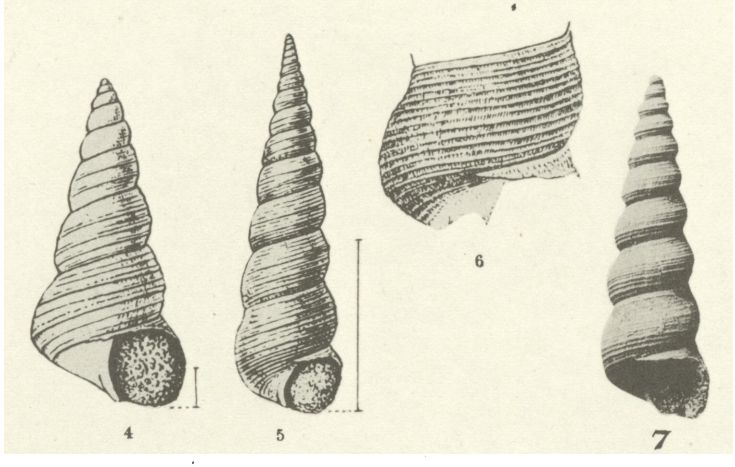
Original Remarks: The shell most closely comparable in outline and sculpture pattern is *Turritella ceibana* Cooke (1928) from the Oligocene of Mexico, but in the Mexican species the constriction at the suture is much more pronounced than in the adult *T. perduensis;* the anterior spiral is relatively stronger, and the posterior spiral is less definitely paired, although there is a beaded secondary behind the primary. The equatorial secondaries are less numerous and not so fine.

Turritella perduensis and *T. ceibana* probably belong to a group distinct from that represented by the larger, coarser shells of *T. halensis* and the closely allied *monroensis, T. bowenae* and the later *T. tampae* of Heilprin.

Turritella perduensis like the other species from the upper Oligocene limestones is known only from molds of the exterior.

PLEBOIDES (VAUGHAN)

TURRITELLA



Figs. 4, 5, 6—Vaughan 1896,
Fig. 7—lectotype, X 2, Bowles 1939.

Type Data: Lectotype No. 495175, paratypes No. 147040, U. S. Nat. Mus., Washington, D.C.

Type Locality: Hammetts Branch, 2 miles northeast of Mount Lebanon, southwest quarter sec. 30, T. 18 N., R. 6 W., in northeastern Bienville Parish, Louisiana.

Geologic Horizon: Cook Mountain formation, Claiborne group, middle Eocene.

Distribution: Cook Mountain formation of Louisiana.

Synonymy:

1895 *Turritella pleboides* Vaughan, T. W., The stratigraphy of northwestern Louisiana: Am. Geologist, vol. 15, p. 213 *(nomen nudum).*

1896 *Mesalia pleboides* Vaughan, T. W., A brief contribution to the geology and paleontology of northwestern Louisiana: U. S. Geol. Survey Bull. 142, p. 36, pl. 3, figs. 4, 5, 6.

1937 *Turritella pleboides*, Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 208, pl. 27, figs. 5, 11, 12.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 311, pl. 33, fig. 7.

Original Description: Size and form indicated by figures. Whorls convex, with a deeply impressed suture, 1–5 smooth. Surface of remaining whorls covered with many revolving, rather coarse, striae, finer ones often being between the coarser. On the median portion of the fifth to the ninth whorls two of the revolving lines are stronger than the others, giving these whorls a subcarinate appearance. The lower of these striae may be decidedly more prominent, thus producing a rather decided carination.

This species bears considerable resemblance to the Miocene *Turritella plebeia*, but is smaller, and has not such coarse striae. The older whorls of the Miocene species in the old forms show indications of loose coiling. I have not seen such in *T. pleboides.*

Observations: Body whorl marked by 14 subequal, distinct revolving lirae which are added to the two primary lirae which are but little larger than the secondaries. Growth lines strongly marked on adult whorls, deeply arcuate, maximum inflection between the posterior third and middle of the whorl.

PLUMMERI STENZEL & TURNER

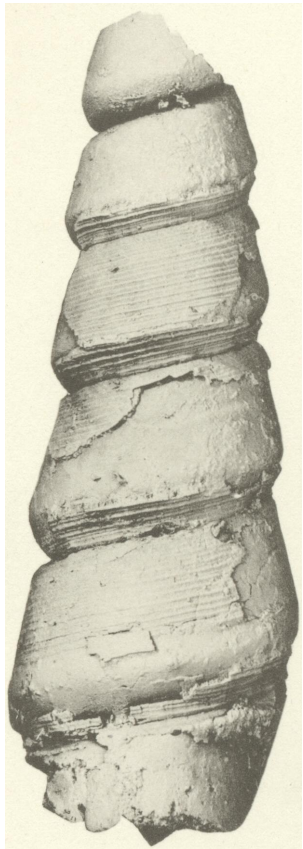


Fig. 1—holotype, X 3, Stenzel & Turner 1940.

Type Data: Monotype, No. 9072, in Plummer collection, Bureau of Economic Geology, The University of Texas, Austin, Texas.

Type Locality: Right bank of Colorado River, ¼ mile below the mouth of Dry Creek and approximately 1¼ miles below the Bastrop-Travis County line, Bastrop County, Texas.

Geologic Horizon: Kincaid formation, Midway group, Paleocene.

Distribution: Kincaid formation of central Texas.

Synonymy:

1933 *Turritella kincaidensis* Plummer, F. B., Cenozoic systems in Texas, *in* The Geology of Texas: Univ. Texas Bull. 3232, p. 815, pl. 10, fig. 3a; not fig. 3.

1940 *Turritella plummeri* Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 839, 840, pl. 47, fig. 1.

Original Description: Apical angle 13°, apical whorls lost. Shell medium in size, thin-walled. Whorls with many fine revolving threads very nearly equal except at basal carina where they are slightly coarser; space between carina and anterior suture with 4 or more revolving threads; beading on spiral threads obsolete. Whorls angulated; anterior slope of angulation a little less than one-half as long as posterior slope; both slopes straight.

Distinguished from *T. kincaidensis* Plummer by the angulated whorls and from *T. hilli* Gardner by the obsolete beading of the spiral lines, finer lines at the angle, and a straight rather than concave posterior slope above the angle.

Prepared by H. B. Stenzel & F. E. Turner, Bureau of Economic Geology, Austin, Texas.

POLYSTICHA STENZEL & TURNER

TURRITELLA

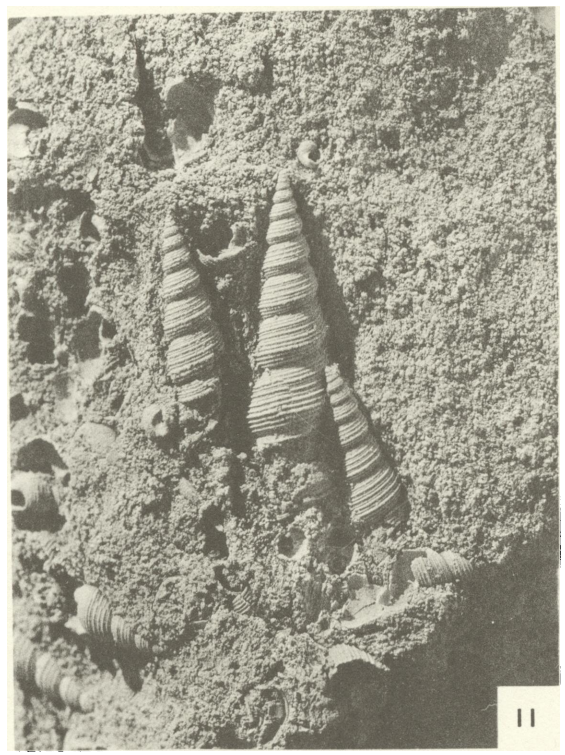


Fig. 11—syntypes, X 3, Stenzel & Turner 1940.

Type Data: Syntypes in Plummer collection, Bureau of Economic Geology, The University of Texas, Austin, Texas.

Type Locality: Solomons Branch, in bank of creek 100 yards west of road, 6 miles southwest of Elgin, Bastrop County, Texas.

Geologic Horizon: Seguin formation, Wilcox group, lower Eocene.

Distribution: Known only from type locality.

Synonymy:

1933 *Turritella* cf. *T. abrupta*, Plummer, F. B., Cenozoic systems in Texas, *in* The Geology of Texas: Univ. Texas Bull. 3232, p. 815, pl. 10, fig. 6.

1940 *Turritella polysticha* Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 837, pl. 47, fig. 11.

Original Description: Shell small; apical angle 28° juvenile, 20° adult; spire profile convex; first three whorls smooth; sculpture consisting of several fine spiral threads begins on fourth whorl. Adult whorls with a rounded angulation near the anterior as well as near the posterior suture, making the sutures deeply channelled. Anterior angulation more conspicuous and one-third whorl height removed from the suture, posterior angulation about one-fourth of the whorl height removed from the other suture. The broad band between the angulations is slightly concave. Sculpture of adult whorls 17 spiral threads partly alternating in strength; three of the threads on some individuals are slightly stronger than the remainder; the lower one of the three is located on the anterior angulation of the whorl. Growth lines forming nearly a perfect, gently curved sigmoid; greatest retraction located between posterior angulation and the middle of the whorl, reflection beginning on the anterior angulation and continuing to the anterior suture.

Observations: Plummer in 1933 referred this species to *T. abrupta* Conrad, which name seems to be a typographical error for *T. obruta* Conrad. Typical *T. obruta* Conrad is a middle Eocene Gosport sand fossil and has very little similarity to *T. polysticha.*

The specific name is derived from the Greek πολύς, many, and στίχος, line, and refers to the ornamentation.

MORTONI POSTMORTONI HARRIS

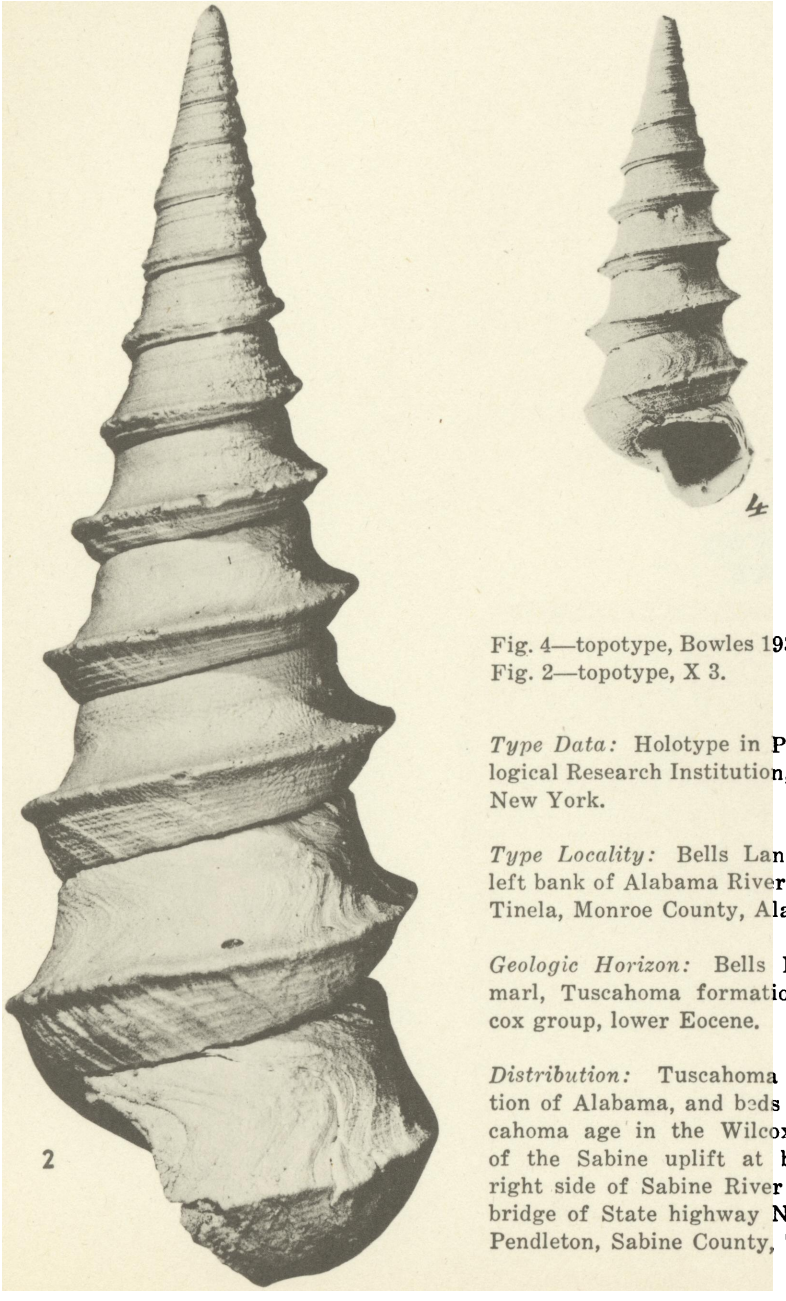


Fig. 4—topotype, Bowles 1934.
Fig. 2—topotype, X 3.

Type Data: Holotype in Paleontological Research Institution, Ithaca, New York.

Type Locality: Bells Landing on left bank of Alabama River west of Tinela, Monroe County, Alabama.

Geologic Horizon: Bells Landing marl, Tuscahoma formation, Wilcox group, lower Eocene.

Distribution: Tuscahoma formation of Alabama, and beds of Tuscahoma age in the Wilcox group of the Sabine uplift at bluff on right side of Sabine River at new bridge of State highway No. 6, at Pendleton, Sabine County, Texas.

Synonymy:

1894 *Turritella mortoni* var. *postmortoni* Harris, G. D., On the geological position of the Eocene deposits of Maryland and Virginia: Am. Jour. Sci., ser. 3, vol. 47, p. 302–304, text fig. 1.

1899 *Turritella mortoni* + var. *postmortoni*, Harris, G. D., The Lignitic stage: Bull. Am. Paleontology, vol. 3, p. 75, pl. 10, figs. 3, 4.

1906 *Turritella mortoni*, Veatch, A. C., Geology and underground water resources of northern Louisiana and southern Arkansas: U. S. Geol. Survey Prof. Paper 46, pl. 14, fig. 5, fig. 5a(?).

1926 Cooke, C. W., The Cenozoic formations, *in* Geology of Alabama: Alabama Geol. Survey, Special Rept. 14, pl. 94, fig. 2.

1939 *T. mortoni postmortoni*, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 298, 299, pl. 33, fig. 4.

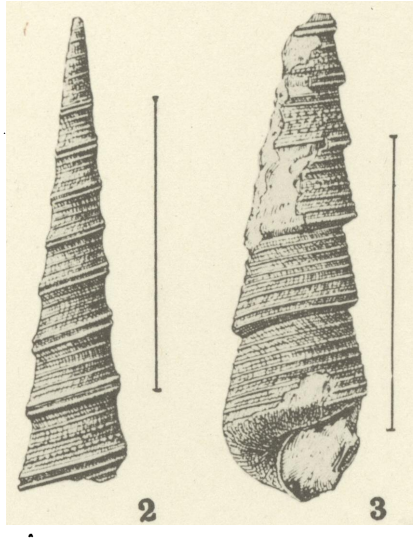
Original Description: Characterized by its rather smaller size, plainer surface, extremely sharp basal carina [in comparison with typical *T. mortoni* Conrad].

Observations: Apical whorls marked by 2 distinct revolving threads and a third slightly fainter. The anterior thread increases in size and marks the angle of the shell, the two posterior threads become nearly equal in size with and surrounded by additional fine revolving lines; with age these lines may become obsolete. Base of whorls with fine threads which may become obsolete with age.

This subspecies is a geographical phase of *T. mortoni* Conrad. Occasional variants of *T. mortoni* from the Aquia formation are practically indistinguishable from *T. mortoni postmortoni* of Alabama.

The early adult whorls of specimens from Bells Landing are very similar to those of *T. rina* Palmer, which may be a descendant of *T. mortoni postmortoni.*

POTOMACENSIS CLARK & MARTIN



Figs. 2, 3—syntypes, Clark & Martin 1901.

Type Data: Two syntypes in Maryland Geol. Survey collection, The Johns Hopkins Univ., Baltimore, Maryland.

Type Locality: Base of bluff on left bank of Potomac River, one mile below Popes Creek, Charles County, Maryland.

Geologic Horizon: Woodstock glauconite marl member of Nanjemoy formation, Wilcox group, lower Eocene.

Distribution: Nanjemoy formation of Maryland and Virginia.

Synonymy:

1901 *Turritella potomacensis* Clark, W. B., & Martin, G. C., Systematic Paleontology, Eocene, Mollusca: Maryland Geol. Survey, Eocene, p. 149, pl. 27, figs. 2, 3.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 310.

Original Description: Shell slender, elongate; whorls many; each whorl carinated at the base, diminishing sharply in diameter toward the apex, and concave in the middle; sculpture consisting of one or two strong, elevated carinae at the base of the whorl, and about five moderately strong ones, irregularly spaced above them, and between these secondary alternating threads and fine, raised, revolving lines; some of the carinae, especially those toward the middle of the whorl, are beaded.

Length, 45 mm.; width, 10 mm.

Observations: This species is smaller and less prominently carinate than *T. mortoni* Conrad and has 5 instead of 3 revolving lirae on the apical whorls. *Turritella gilberti* Bowles has more quadrate whorls separated by more deeply impressed sutures and is less prominently carinate.

PRAECINCTA CONRAD

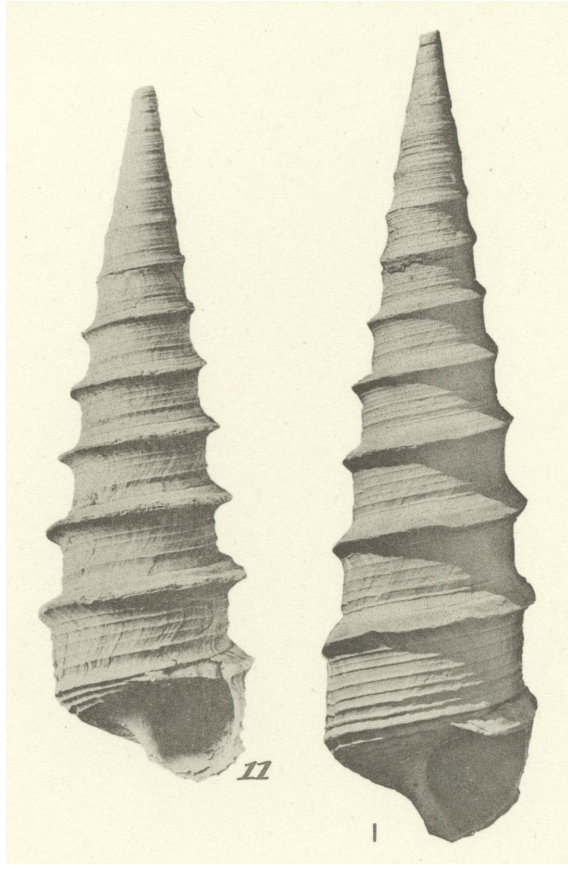


Fig. 11—figured specimen, X 1, Bowles 1939.
Fig. 1—specimen, X 1.

Type Data: Holotype lost. Specimen figured, Bowles 1939, No. 497991, U. S. Nat. Mus., Washington, D.C.

Type Locality: Unknown, given by Conrad as "Dallas County?, Alabama."

Geologic Horizon: Tuscahoma formation, Wilcox group, lower Eocene. Figured specimen from Bells Landing on left bank of Alabama River west of Tinela, Monroe County, Alabama.

Distribution: Tuscahoma formation of Alabama.

Synonymy:

1864 *Turritella praecincta* Conrad, T. A., Notes on shells, with descriptions of new fossil genera and species: Acad. Nat. Sci. Philadelphia, Proc. for 1864, p. 211.

1899 Harris, G. D., The Lignitic stage: Bull. Am. Paleontology, vol. 3, p. 76, p. 10, fig. 8.

1899 Harris, G. D., A preliminary report on the geology of Louisiana: Louisiana Geol. Survey, Rept. for 1899, p. 308, pl. 55, fig. 6.

1926 Cooke, C. W., The Cenozoic formations, *in* Geology of Alabama: Alabama Geol. Survey, Special Rept. 14, pl. 94, fig. 3.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 318, 319, pl. 33, fig. 11.

Original Description: Turrited, broad at base; sides straight, a profoundly elevated, thick, angular carina revolves at the summit of each volution, gradually disappearing at the fourth whorl; carina slightly channelled above, and having a single revolving line beneath near its junction with the whorls, which have each three revolving lines, the inferior one most prominent. Length 3⅝ inches; width of body whorl, independent of carina, ¾ inch.

This large species differs from *T. Mortoni* in having a larger and more abruptly elevated carina, larger and fewer revolving striae, &c. It is allied to *T. rotifera*, Lam. The specimen described was loaned for the purpose by Mr. R. P. Whitfield. Other specimens are in Barnum's Museum, N. Y.

Observations (Bowles 1939): Early whorls marked by five revolving lirae, the posterior four equal in strength and equidistant from each other, the anterior lira stronger than the others and more distantly placed from them than they are from one another; a fine secondary line appearing between the two anterior lirae, on the fourth or fifth whorl; the posterior lira becoming rapidly more elevated after the eighth whorl until by the time the shell has attained its tenth volution there is a marked carination of the whorl immediately in front of the suture; a fine line appearing on the base of this carination at about the eleventh whorl; base of body whorl marked by eight additional strong, revolving cords. Growth lines indistinct on the apical whorls becoming more prominent with the growth of the shell; deeply arcuate, the maximum retraction occurring at about the posterior third of the whorl. Complete aperture not observed. Base of body whorl marked by a thin parietal wash.

RINA PALMER

TURRITELLA

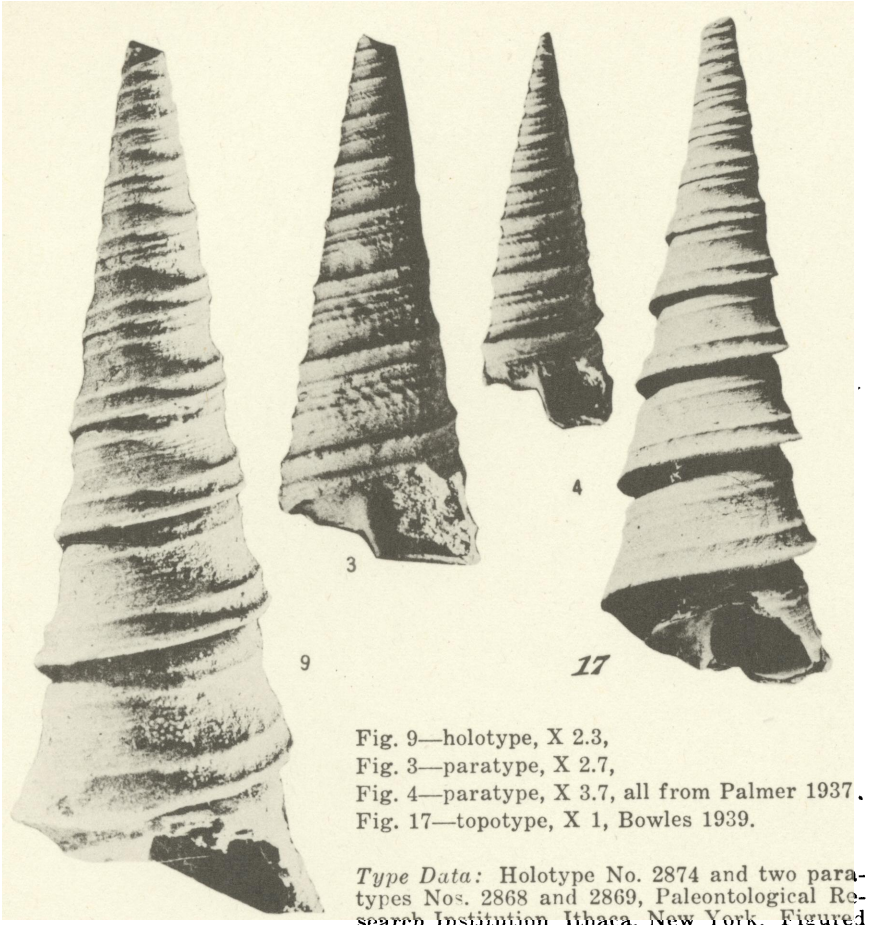


Fig. 9—holotype, X 2.3,
Fig. 3—paratype, X 2.7,
Fig. 4—paratype, X 3.7, all from Palmer 1937.
Fig. 17—topotype, X 1, Bowles 1939.

Type Data: Holotype No. 2874 and two paratypes Nos. 2868 and 2869, Paleontological Research Institution, Ithaca, New York. Figured topotype No. 495170, U. S. Nat. Mus., Washington, D.C.

Type Locality: Lower part of Claiborne bluff on left bank of Alabama River, Monroe County, Alabama.

Geologic Horizon: Lisbon formation, Claiborne group, middle Eocene.

Distribution: Lisbon formation of Alabama, and Wautubbee formation of Mississippi. Reported by Bowles 1939 from McBean formation of South Carolina and Georgia, and Cook Mountain formation of Louisiana. All in Claiborne group, middle Eocene.

Palmer 1937 reports 2 specimens from the Gosport sand, but neither Bowles nor Stenzel & Turner have found any in that sand. The two specimens may be intermediates of *T. carinata-ghigna*, which are very similar.

Synonymy:

1936 *Turritella carinata praecarinata* Cooke, C. W., Geology of the Coastal Plain of South Carolina: U. S. Geol. Survey Bull. 867, p. 63 *(nomen nudum).*

1937 *T. rina* Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda, and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 192, 193, pl. 22, figs. 3, 4, 9.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 277, 278, 279, pl. 31, fig. 17.

Original Description (emended): Apical angle 15° to 17°; nepionic whorls with 3 spiral ribs, posterior rib faint, medial and basal ribs prominent. Posterior rib gradually increases as the medial rib decreases so that with the 6th or 7th whorl the whorls are widely bicarinate with a fine line medially; ribs, particularly the small medial one, are usually beaded, but may become smooth with old age; a fine rib develops between posterior spiral and suture in adult whorls; a basal carina develops out of the suture; as basal carina develops the whorls become more loose coiled and obtain a deep sutural groove; fine striae present over base and entire surface of whorls.

Observations: The species listed below are very closely related and characterized by incrementals distinct, deeply arcuate, attaining maximum curvature on the medial or between the medial and posterior carinae, strongly recurved below the basal carina.

Distinctions:

T. rina Palmer. Basal carina derived from anterior suture, anterior and posterior primary spirals remain prominent, medial primary spiral obscure on adult whorls.

T. rina carolina Palmer. Early whorls bicarinate, later developing strong medial rib, thereby differing from *T. rina* Palmer and *T. subrina* Palmer. From *T. ghigna* it is distinguished by narrower apical angle and bicarinate early whorls.

T. rina subrina Palmer. Adult whorls have 2 prominent, equal, widely separate, revolving ribs and 2 lesser spirals, located one between anterior primary and anterior suture and the other between posterior primary and posterior suture.

T. ortezi Bowles has a very prominent posterior carina. Anterior carina less strongly developed in adult whorls, secondary cord inconspicuous or absent.

T. carinata Lea. Basal carina derived from anterior accessory spiral, primary spirals become obscure, early whorls very slender with 3 obscure spirals.

T. carinata Lea-*ghigna* De Gregorio intermediates. Three-ribbed early whorls; adult whorls have strong basal carina derived from anterior accessory spiral, and 4–5 lighter spirals derived from primary and accessory spirals.

T. ghigna De Gregorio. Three-ribbed early whorls; adult whorls robust, usually 5 well developed nearly equal spirals, fine striations over entire whorl.

T. carinata palmerae Bowles. Three-ribbed early whorls; adult whorls have rounded basal carina and numerous subequal revolving lirae with fine striations between, greatest diameter of whorl through anterior accessory ribs.

T. perdita Conrad. Early whorls 3 ribbed; adult whorls with rounded basal carina with greatest diameter at anterior primary rib.

RIVURBANA COOKE

Fig. 10—holotype, X 2, Cooke 1926.

Type Data: Holotype No. 353946, U. S. Nat. Mus., Washington, D.C.

Type Locality: Town Creek 200 yards south of the intersection of Rankin and State streets in Jackson, Hinds County, Mississippi.

Geologic Horizon: Moodys marl, Jackson group, upper Eocene.

Distribution: Moodys marl, Hinds and Yazoo counties, Mississippi.

Synonymy:

1926 *Turritella rivurbana* Cooke, C. W., New Eocene Mollusca from Jackson, Mississippi: Washington Acad. Sci. Jour., vol. 16, p. 136, fig. 10.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 283, 284.

Original Description: Apical angle about 20°. Whorls carinated, slightly constricted medially, suture depressed; spiral sculpture of one strong thread on the carina and several finer, widely spaced threads. Altitude of a fragment of 5 whorls 17 mm.; latitude 8 mm.

Observations: Adolescent and adult whorls marked by two strong revolving lirae, one very near the anterior and one close to the posterior suture; the anterior lira stronger and distinctly carinating the whorl; early fine accessory spirals becoming more indistinct with growth of shell; entire surface of whorl sculptured with microscopic revolving lines; growth lines distinct but not prominent, strongly arcuate, deepest part of sinus falling a little behind the middle of the whorl, an additional very slight reflection apparent on the underside of the anterior carina.

The bicarinate adult whorls distinguish this species from the multilirate *T. alveata* Conrad, *T. perdita* Conrad, *T. perdita lowei* Cooke, and *T. perdita jacksonensis* Cooke. The small size and lack of strong secondary sculpture distinguish it from *T. subtilis* Kellum and *T. martinensis* Dall.

SAFFORDI GABB

TURRITELLA

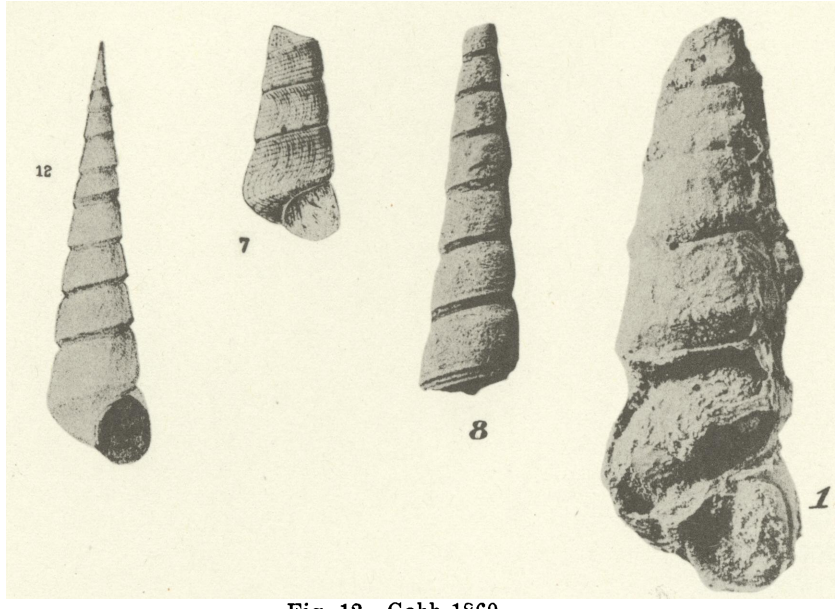


Fig. 12—Gabb 1860.

Fig. 7—syntype Gabb 1860, figured by Harris 1896.

Figs. 8,1—specimens from east of Middleton, Hardeman county, Tennessee, Bowles 1939.

Type Data: Syntypes in J. M. Safford collection, Vanderbilt Univ., Nashville, Tennessee, according to Harris 1896. Could not be located by Bowles 1939.

Type Locality: Near Middleton in the vicinity of the Memphis and Charleston railroad either to both sides of the railroad near Muddy Creek or in a small cut on the railroad about 2 miles east of Middleton or about 2 miles east or southeast of Middleton on a branch of Cypress Creek near the old stage road, southeastern Hardeman County, Tennessee (compare Safford, J. M., Geology of Tennessee, p. 418–419, 1869). Fig. 8 from milepost 481 east of Middleton, Hardeman County, Tennessee.

Geologic Horizon: Clayton formation, Midway group, Paleocene.

Distribution: Midway group of Tennessee and Mississippi.

Synonymy:

1860 *Turritella saffordi* Gabb, W. M., Descriptions of new species of American Tertiary and Cretaceous fossils: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 4, p. 392, pl. 68, fig. 12.

1896 Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 223, pl. 21, fig. 7.

1933 Not Plummer, F. B., Cenozoic systems in Texas, *in* The Geology of Texas: Univ. Texas Bull. 3232, p. 815, pl. 10, fig. 1.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 309, pl. 33, figs. 1, 8.

Original Description: Scalariform; whorls eight or ten, somewhat carinated below, flattened on the side; suture profound; mouth subquadrate; surface marked by three small revolving lines on the lower portion of the whorl, near the suture, and on some specimens by obscure revolving lines near the whole whorl, always crossed by waved lines of growth.

Dimensions: Length (restored) 2.2 in., width of body whorl .6 in., length of mouth .4 in.

Observations (Bowles 1939 abbreviated): Apex unknown, earliest whorls preserved have very fine revolving lines over entire surface; revolving ribs almost obsolete on the older whorls except for the 3 stronger ribs under the carina. Growth lines conspicuous, deeply flexed well above the middle of the whorl, reflexed anteriorly, and meeting the anterior suture just a little behind their intersection with the posterior suture.

HUMEROSA SANJUANENSIS BOWLES

Fig. 18—holotype, Bowles 1939.

Type Data: Holotype No. 494986, paratype No. 494987, U. S. Nat. Mus., Washington, D.C.

Type Locality: Upstream section just east of fault, Rio San Juan, Nuevo León, Mexico.

Geologic Horizon: Lower part of Wilcox group, lower Eocene.

Distribution: Lower part of Wilcox group, Nuevo León, Mexico.

Synonymy:

1939 *Turritella humerosa sanjuanensis* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 314, pl. 34, fig. 18.

Original Description: Spire elongated, very gradually tapering. Whorls narrow, much higher than wide, with almost straight sides, contracted slightly posterior to the suture and again just anterior to the subsutural collar. Sutures linear and distinctly impressed, particularly after the appearance of the subsutural collar, which slightly overrides them on the adult whorls. Apical whorls not preserved on any of the specimens; earliest adolescent whorls marked by six or seven distinct but not prominent subequal revolving lines; secondary lines added with the growth of the shell until on the adult whorls there are ten or twelve lirae, the secondaries increasing in prominence until they are as strong as the primaries; posterior margin of adult whorls thickened into a distinct subsutural collar, comparable to that of *Turritella humerosa;* a slightly contracted space immediately behind the anterior suture sculptured only by very fine revolving lines. Incrementals distinct, strongly marked on the adult whorls, sharply recurved at about the posterior third of the whorl, slightly reflexed just behind the suture, cutting the revolving lirae on the adult whorls into a series of irregular beads. Aperture unknown.

Dimensions: Holotype (an incomplete individual with but three adult whorls preserved), height, 30.0 mm; greatest diameter, 10.5 mm. Paratype (an incomplete individual with 3½ adolescent whorls preserved), height, 13.5 mm; greatest diameter, 4.0 mm.

Observations (Bowles 1939): The distinct subsutural collar of *Turritella humerosa sanjuanensis* indicates its close relationship to the *T. humerosa* group of the Eastern Gulf province, but it is readily distinguished from the typical form of the Maryland Aquia formation by the extreme elongation of the whorls and the very gradually tapering spire. The subsutural collar is more closely comparable to that of *T. humerosa*, s.s., than to the posterior carina of *T. bellifera*, for it is formed by a thickening of the shell over which the sculpture continues unchanged, rather than the extreme development of one of the revolving lirae.

The only other species of the Turritellidae with which *Turritella humerosa sanjuanensis* is associated is *Mesalia sayi* Bowles, n.sp., so that a close dating of the deposits from which *T. sanjuanensis* has been recorded is rendered impossible from the Turritellas alone.

NASUTA SMITHVILLENSIS BOWLES

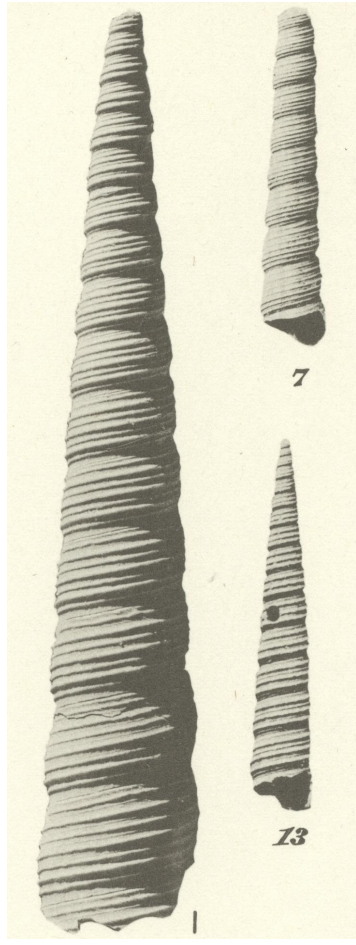


Fig. 7—holotype, X 2,
Fig. 13—paratype, X 4; Bowles 1939.
Fig. 1—topotype, X 3.

Type Data: Holotype No. 497998, paratype No. 497999, U. S. Nat. Mus., Washington, D.C.

Type Locality: Bluff on right bank of Colorado River upstream from highway bridge at Smithville, Bastrop County, Texas.

Geologic Horizon: Viesca member, Weches formation, Claiborne group, middle Eocene.

Distribution: Weches formation central and east Texas.

Synonymy:

1937 *Turritella nasuta*, Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 200, pl. 25, figs. 5, 6 only.

1939 *Turritella nasuta smithvillensis* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 289, 290, pl. 32, figs. 5, 6.

Original Description: Shell small. Spire high, slender, very gradually tapering. Whorls very numerous, rounded, slightly wider than high when young, becoming almost equidimensional when adult. Sutures distinct, linear, deeply impressed, sharply constricting the whorls throughout the growth of the shell. Apical whorls marked by three revolving lirae, the medial slightly closer to the anterior than to the posterior; posterior lira slightly smaller than the two anterior on the earliest whorls, rapidly increasing in size until the three are subequal in strength on the adolescent and adult whorls; a fine revolving lira appearing between the primaries and the posterior suture on the sixth whorl; lirae appearing also between the primaries and between the anterior primary and the anterior suture on the tenth whorl; secondaries rapidly increasing in size with the growth of the shell until the adult whorls are marked by seven subequal revolving lirations with five or more finer lines irregularly placed between them; very fine spiral threading covering the entire surface of the post-nuclear whorls. Incrementals distinct, strongly marked, deeply arcuate, the maximum retraction occurring just behind the median of the whorl, slightly recurved a little above the suture. Aperture slightly higher than wide. Outer lip fragile, not preserved entire. Parietal wash small, thin, indistinct.

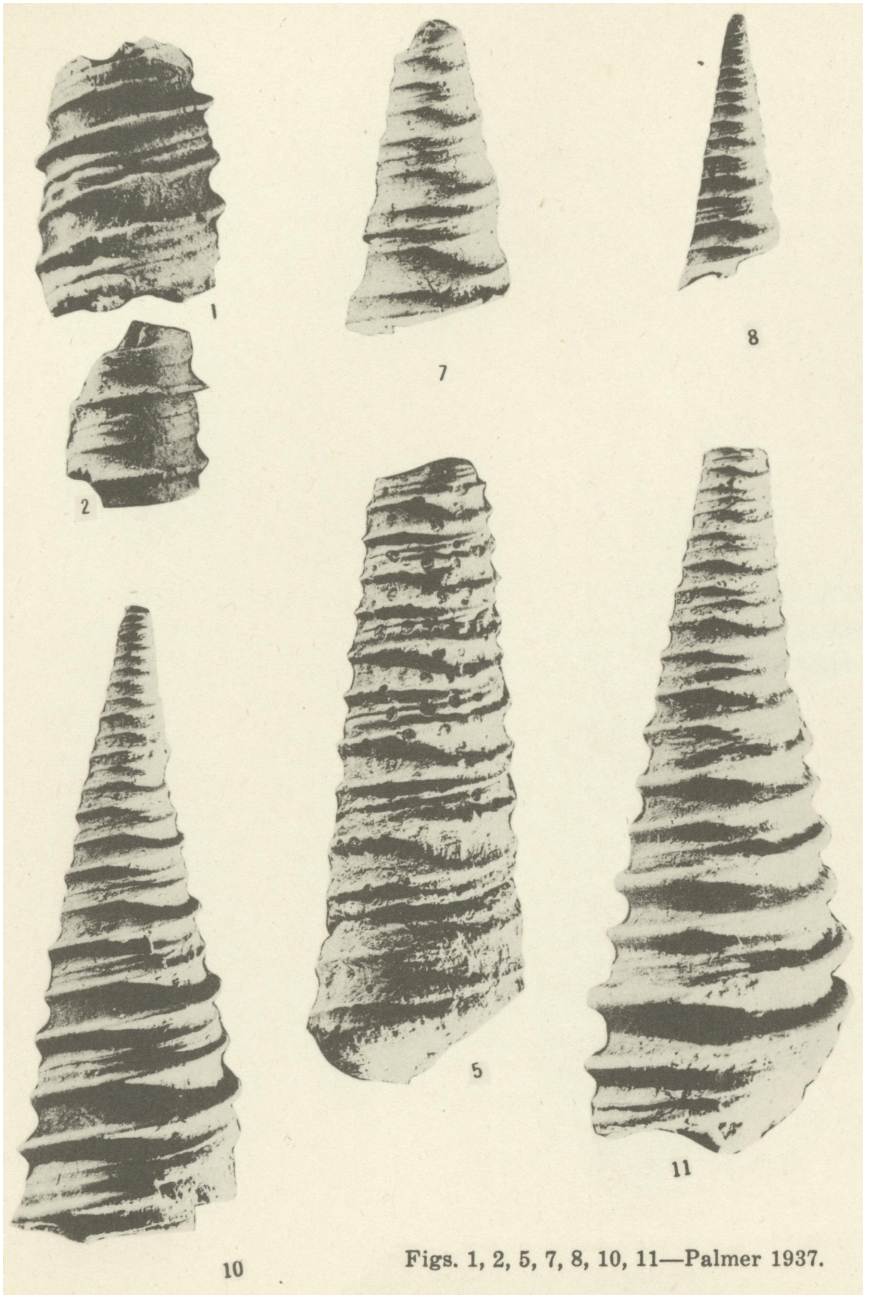
Dimensions: Holotype (broken slightly at the apex), height, 22.8 mm; greatest diameter, 4.5 mm. Paratype (broken at the aperture), height, 12.2 mm; greatest diameter, 2.2 mm.

Observations (Bowles 1939): The subspecies *smithvillensis* may be distinguished from *Turritella nasuta*, s.s., by its more rounded whorls and more deeply incised sutures. It has been recovered only from deposits of Weches age in Texas, where it is the sole representative of the *Turritella nasuta* stock. It is nowhere very abundant, but it is not rare at Smithville.

Observations (Stenzel & Turner 1939): The juvenile and early adult stages of *T. nasuta smithvillensis* have well beaded primaries; the beading is absent or nearly absent in *T. nasuta* Gabb and *T. nasuta brazita* Stenzel & Turner.

RINA SUBRINA PALMER

TURRITELLA



Figs. 1, 2, 5, 7, 8, 10, 11—Palmer 1937.

Synonymy:

1937 *Turritella rina subrina* Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 194, pl. 22, figs. 1, 2, 5, 7, 8, 10, 11.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 279, 280, pl. 31, fig. 16.

Original Description (emended): Shell large, robust; apical angle 18°; first nepionic whorls with 3 spiral ribs; middle rib smallest, disappears with maturity and shell becomes bicarinate; anterior primary carina at first larger, later same size as posterior one; two accessory spirals develop one anterior to the anterior primary rib, the other posterior to the posterior primary rib; these 2 accessory ribs may become prominent, but do not reach the size of the 2 primary carinas. Spiral ribs may be beaded in youth; fine striae present over base and entire surface of whorls.

Dimensions: Syntype No. 2866 (fig. 1), height 17 mm., diameter 15 mm.; syntype No. 2867 (fig. 2), height 10 mm., diameter 10 mm.; syntype No. 2870 (fig. 5), height 68 mm., diameter 22 mm.; syntype No. 2871 (fig. 8 apex of fig. 10), height 9 mm., diameter 4 mm.; syntype No. 2871 (fig. 10), height 33 mm., diameter 12 mm.; syntype No. 2875 (fig. 11), height 41 mm., diameter 14 mm.

Observations: This subspecies is one of a related group of species whose distinctions are given under *T. rina* Palmer.

Type Data: Five syntypes, Nos. 2866, 2867, 2870, 2871, and 2875, in Paleontological Research Institution, Ithaca, New York.

Type Locality: Bluff about 1 mile south of Lisbon Landing on right bank of Alabama River, Monroe County, Alabama (Nos. 2866, 2867). Lower part of Claiborne Bluff, left bank of Alabama River, Monroe County, Alabama (Nos. 2870, 2871, 2875).

Geologic Horizon: Lisbon formation, Claiborne group, middle Eocene.

Distribution: McBean formation of South Carolina, Lisbon formation of Alabama, and Wautubbee formation of Mississippi, all in Claiborne group, middle Eocene.

Fig. 5—Kellum 1926.

Type Data: Monotype No. 353240, U. S. Nat. Mus., Washington, D.C.

Type Locality: City rock quarry near Smith Creek, east side of Wilmington, New Hanover County, North Carolina.

Geologic Horizon: Castle Hayne marl, Jackson group, upper Eocene.

Distribution: Known only from type locality.

Synonymy:

1926 *Turritella subtilis* Kellum, L. B., Paleontology and stratigraphy of the Castle Hayne and Trent marls in North Carolina: U. S. Geol. Survey Prof. Paper 143, p. 27, pl. 5, fig. 5. Not *T. subtilis* Stephenson 1927 (= *T. kellumi* Stephenson).

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 283.

Original Description: Shell coiled, slender, tapering; suture simple, distinct, not deeply impressed; sculpture delicate; whorls divided into three subequal parts by two low, sharp spiral threads, between which is a third, less prominent thread; lower whorls have, at base bordering the suture, another spiral thread, which becomes obsolete in the higher whorls; indistinct axial growth lines. Total number of whorls and shape of aperture unknown. Length of fragment of 10 whorls, 24 millimeters.

The type specimen of this species is a cast of the exterior of the shell, preserving the most delicate sculpture.

Observations (Bowles 1939): It is apparently closely related to *T. martinensis* Dall of the Ocala limestone of northern Georgia and Florida and the allied specimens from the Barnwell sand of northern Georgia and to *T. rivurbana* Cooke of the Moodys marl of Mississippi. All three species are characterized by the cingulate sculpture of the apical whorls. *Turritella subtilis*, however, is more slender and gradually tapering than other cingulate Jackson species, and the whorls are marked by more prominent secondary lirae.

TENNESSEENSIS GABB

TURRITELLA

Fig. 5—presumably one of Gabb's syntypes figured by Harris 1896.

Type Data: Several syntypes, collection of J. M. Safford, Vanderbilt Univ., Nashville, Tennessee, according to Harris 1896. Could not be located by Bowles 1939.

Type Locality: Small cut on Memphis and Charleston railroad, 2 miles east of Middleton, southeastern Hardeman County, Tennessee (compare Safford, J. M., Geology of Tennessee, p. 419, 1869).

Geologic Horizon: Clayton formation, Midway group, Paleocene.

Distribution: Clayton formation of Tennessee.

Synonymy:

1860 *Turritella tennesseensis* Gabb, W. M., Descriptions of new species of American Tertiary and Cretaceous fossils: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 4, pt. 4, p. 392, pl. 68, fig. 13.

1896 Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 222, pl. 21, fig. 5.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 284, 285, pl. 32, fig. 10(?).

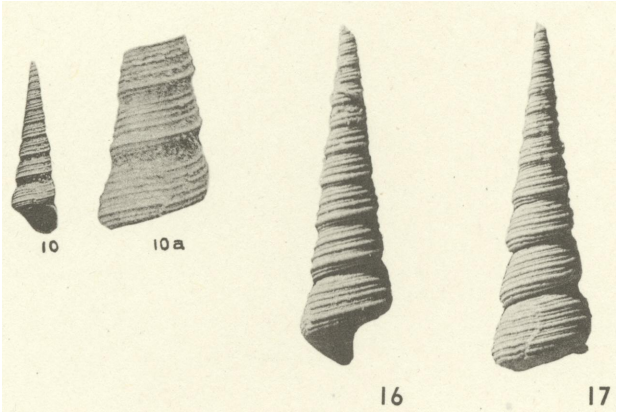
Original Description: Turrited, spire high; whorls? (10?) flattened or concave on the side, carinated strongly below; mouth subquadrate; surface marked by numerous revolving striae, two or three of which are generally larger than the rest, the remainder usually alternating, one or two small ones with one slightly larger.

Dimensions: Length (restored)? 1.2 in.?; width of body whorl one inch from apex, .35 in.

Observations: Turritella tennesseensis as figured by Bowles 1939 appears quite different from the type as figured by Harris 1896. Bowles' specimen has a pronounced swelling of the posterior portion of the whorl adjacent to the suture above the obscure posterior primary lira. Harris' illustration indicates an emphasis of the posterior primary lira without a pronounced swelling posterior to it. The maximum diameter as shown by Harris comes through a rounded carina located approximately at the anterior primary lira; as shown by the Bowles 1939 specimen the maximum diameter is the flanged basal margin below the anterior primary lira.

TURNERI PLUMMER

TURRITELLA



Figs. 10, 10a—syntypes, X 1.5 and 3.7, Plummer 1933.
Figs. 16, 17—syntypes, X 3.

Type Data: Four syntypes, No. P5419, in Plummer collection, Bureau of Economic Geology, The University of Texas, Austin, Texas.

Type Locality: Old copper prospect 4½ miles northeast of Harwood, Alsabrook place, Pullen survey, Caldwell County, Texas.

Geologic Horizon: Marquez shale member, Reklaw formation, Claiborne group, middle Eocene.

Distribution: Marquez shale member and lower and middle part of Queen City formation in central Texas.

Synonymy:

1933 *Turritella turneri* Plummer, F. B., Cenozoic systems in Texas, *in* The Geology of Texas: Univ. Texas Bull. 3232, p. 625, 815, pl. 10, figs. 10, 10a, not p. 583.

1937 *Turritella mortoni turneri,* Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 195, pl. 23, figs. 4, 5 (only).

1939 *Turritella dumblei turneri,* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 304.

1940 *Turritella turneri* Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 836, pl. 47, figs. 16, 17.

Original Description: Apical angle 17½°, sculpture consisting of 5 unequal spirals, anterior spiral the largest, shape of whorl strongly convex, posterior whorl slope slightly longer than anterior.

Observations: Three spirals developing from primary lirae usually show stronger on the adult whorls than subsequently developed lirae of which there may be either 1 or 2. Major spirals may be either 4 or 5 in number and are usually finely beaded. Fine revolving striae appear between the lirae early in the development of the shell. Shell profile straight to slightly concave. The whorls are not strongly convex as stated by Plummer, but rather angulated near the posterior suture, making the suture appear deeply channelled. Distinguished from *T. infans* Stenzel & Turner, n.sp., by the concave profile of the shell, narrower apical angle, and more pronounced striation between the 4 or 5 major revolving ribs.

VAUGHANI BOWLES

TURRITELLA

Fig. 14—holotype, Bowles 1939.

Type Data: Holotype No. 497935, U. S. Nat. Mus., Washington, D.C.

Type Locality: Poosers Hill, 5.1 miles north of Orangeburg courthouse, on Orangeburg-Columbia road, Orangeburg County, South Carolina.

Geologic Horizon: McBean formation, Claiborne group, middle Eocene.

Distribution: Known only from type locality.

Synonymy:

1939 *Turritella vaughani* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 282, pl. 32, fig. 14.

Original Description: Shell very small. Spire high, extremely slender, gradually tapering. Whorls eleven in number in the incomplete holotype, flatsided, separated by distinct but not deeply impressed sutures. Sculpture the same on all the whorls, consisting of two not very prominent revolving carinae, one near the anterior and one close to the posterior suture, the space between them much greater than that between either of them and the suture; medial space between revolving cords smooth, unmarked except for the indistinct growth lines. Incrementals recurved, the maximum retraction being just anterior to the posterior carina. Outer lip not preserved.

Dimensions: Holotype, height, 10.0 mm; greatest diameter, 2.0 mm. Holotype broken at aperture and apex.

Observations (Bowles 1939): Turritella vaughani is unique among the Turritellas of the Gulf and Atlantic Eocene, being more suggestive of the cingulate Jackson species *T. subtilis* Kellum, *T. martinensis* Dall and *T. rivurbana* Cooke than of the contemporary *T. rina* group. It is possible that the specimens here described are juveniles, but the sculpture is distinct from the apical sculpture of any other species, and since eleven whorls are present in the holotype, it is probable that more than the very youngest whorls are represented.

Turritella vaughani is represented in the collections of the National Museum only by the holotype and a single topotype.

WECHESENSIS BOWLES

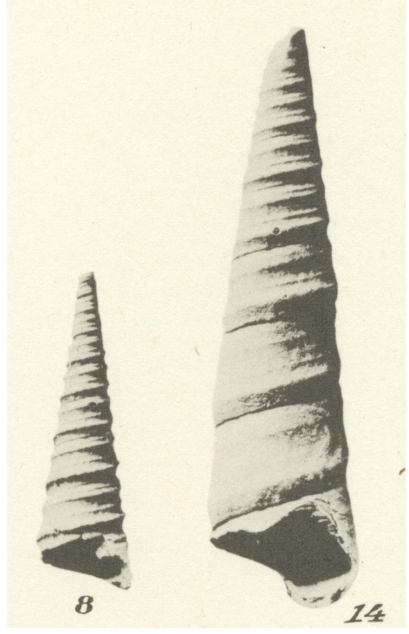


Fig. 8—paratype, X 3,
Fig. 14—holotype, X 2; Bowles 1939.

Type Data: Holotype No. 497958, paratype No. 497959, U. S. Nat. Mus., Washington, D.C.

Type Locality: Water well at Percilla, northeastern Houston County, Texas.

Geologic Horizon: Weches formation, Claiborne group, middle Eocene.

Distribution: Weches formation of Houston and Robertson counties, Texas, according to Bowles 1939.

Synonymy:

1939 *Turritella wechesensis* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 281, 282, pl. 31, figs. 8, 14.

Original Description: Shell rather large, heavy. Spire high, gradually tapering. Whorls flat-sided in youth, slightly carinated when adult, separated by deeply impressed, linear sutures. Apical whorls marked by two prominent revolving lirae, one near the posterior suture and the other an equal distance from the anterior suture; a smaller revolving cord appearing between the two primaries and equidistant from them; an additional very small and indistinct lira appearing early between the posterior carina and the posterior suture; both the secondaries somewhat beaded at their intersections with the growth lines; entire surface of whorls marked by numerous very fine spiral threading; sculpture increasing in strength until about the tenth whorl, then gradually becoming less prominent with the growth of the shell, the two secondaries disappearing on the adult whorls; anterior primary developing into a distinct basal carination, sharper on the adolescent than on the adult whorls, but persisting throughout the shell development; posterior primary much reduced on the adult whorls until it is little more than a fine spiral thread on the body whorl, almost indistinguishable from the numerous fine revolving lines that cover the adult whorls. Incrementals distinct, very prominent, sharply cutting the spiral sculpture of the apical whorls and slightly beading the smaller revolving lirae; deeply arcuate, attaining their maximum curvature at about the posterior third of the whorl, very slightly reflexed at the anterior suture. Aperture not preserved entire.

Dimensions: Holotype (broken at the apex): height, 39.0 mm; greatest diameter, 10.0 mm. Paratype (broken at the aperture), height, 14.0 mm; greatest diameter, 4.0 mm.

Observations (Bowles 1939): Turritella wechesensis differs from any other species of the Gulf Eocene in the obliteration of the sculpture on the adult whorls. At first glance the fully grown specimens seem to be simply worn, but on closer examination, the shell is found to be intact—even the finest of the revolving lines is preserved all the way to the body whorl. The early whorls somewhat resemble those of *Turritella rina*, especially after the decrease of the posterior carina sets in, but the ultimate extinction of the carina and the disappearance of the secondary ribbing readily distinguish this species.

ALABAMIENSIS (WHITFIELD)

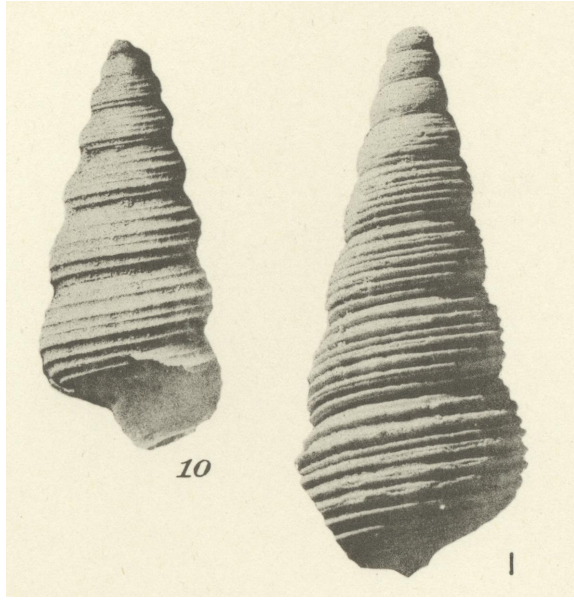


Fig. 10—syntype, X 2, Bowles 1939.
Fig. 1—topotype, X 3.

Type Data: Several syntypes No. 24520, in James Hall collection, Walker Museum, Univ. of Chicago, Chicago, Illinois.

Type Locality: Probably Greggs Landing, about 2 miles above Bells Landing, Monroe County, Alabama. Mistakenly given as six miles below Prairie Bluff, Alabama, by Whitfield (compare Aldrich, T. H., Notes on Tertiary fossils, with descriptions of new species: Cincinnati Soc. Nat. History, Jour., vol. 10, p. 79, 1887).

Geologic Horizon: Tuscahoma formation, Wilcox group, lower Eocene.

Distribution: Tuscahoma formation of Alabama.

Synonymy:

1865 *Potamides alabamiensis* Whitfield, R. P., Descriptions of new species of Eocene fossils: Am. Jour. Conchology, vol. 1, p. 266, pl. 27, fig. 13.

1890 de Gregorio, A., Monographie de la faune Éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 124, pl. 11, fig. 12.

1896 Not *Mesalia alabamiensis*, Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 227, pl. 22, fig. 1 = *Mesalia alabamiensis bowlesi* Stenzel & Turner.

1899 *Mesalia pumila* var. *alabamiensis*, Harris, G. D., The Lignitic stage: Bull. Am. Paleontology, vol. 3, p. 76, 77, pl. 10, fig. 9.

1939 *Mesalia alabamiensis* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 327, 328, pl. 34, fig. 10.

Original Description: Shell turrited, consisting of about eight short, strong, rounded volutions; columella short; aperture obliquely ovate, lower basal portion auger-shaped; entire surface marked by strong, sharply elevated revolving lines, strongest on the middle of the volution; eleven can be counted on the body whorl; the revolving lines are crossed by faint lines of growth, which have a slight sigmoidal curve.

Dimensions.—Length of shell 1.12 inches, transverse diameter of body whorl .45 inch.

Observations: Apical whorls with 2 well marked primary lirae and a faint posterior third lira. A secondary lira appears on the third or fourth whorl between the 2 anterior lirae and occasionally a fifth between the posterior lirae and the suture; these increase in size until the sides of the adult whorls are marked by 7 strong revolving subequal ribs. Base of body whorl has five or six additional spiral ribs. Growth lines indistinct, slightly arcuate; aperture rounded. *Mesalia alabamiensis tetradeiras* Stenzel & Turner has 4–5 lirae on spire whorls.

ALLENTONENSIS (ALDRICH)

MESALIA

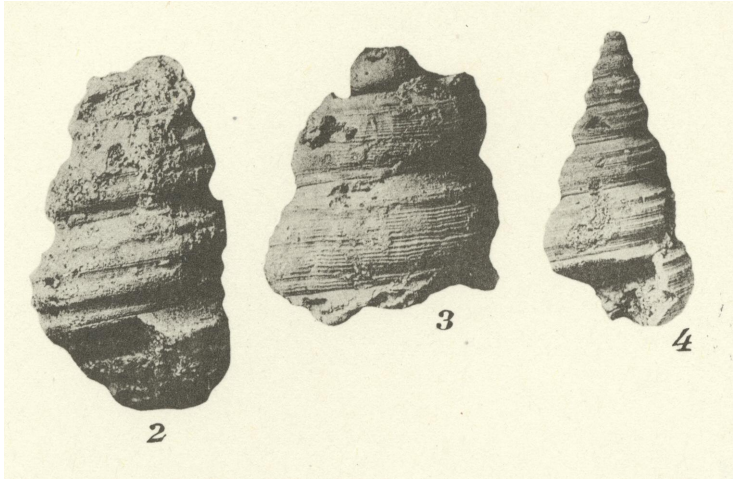


Fig. 2—holotype of *wilcoxiana* Aldrich, X 2,
Fig. 3—holotype of *allentonensis* Aldrich, X 2,
Fig. 4—paratype of *allentonensis* Aldrich, X 2; all figured by Bowles 1939.

Type Data: All figured types in Aldrich collection, Geological Department, The Johns Hopkins Univ., Baltimore, Maryland.

Type Locality: Both, *M. allentonensis* and *M. wilcoxiana*, from Prairie Creek approximately 3 miles north of Oakhill, Wilcox County, Alabama.

Geologic Horizon: Clayton formation, Midway group, Paleocene.

Distribution: Clayton formation of Alabama, Black Mingo formation of South Carolina, and undifferentiated Midway group of Arkansas.

Synonymy:

1894 *Turritella allentonensis* + *wilcoxiana* Aldrich, T. H., The (Midway) Clayton Tertiary section and its fossils, *in* Report on the Coastal Plain of Alabama, Alabama Geol. Survey, p. 246, 247, pl. 13, figs. 4a, 4b, 6.

1896 *Mesalia pumila* var. *wilcoxiana* + *pumila* var. *allentonensis* + *watsonensis* Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 226, 227, 228, pl. 21, figs. 16, 17, 20, 21, pl. 22, fig. 2.

1939 *Mesalia wilcoxiana*, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 324, 325, pl. 34, figs. 2, 3, 4.

Original Description of allentonensis: Whorls rounded and covered with close set fine spiral lines, a corded space below the suture followed by a concave space, the middle of the whorl with another depressed space; below this a raised space with two fine spiral lines on the periphery of same, then a concave area to the suture.

Redescription (Bowles 1939): Spire high, abruptly tapering. Whorls rounded and highly inflated; sutures distinct and deeply impressed. Sculpture consisting of two very large, coarse, revolving cords medially situated on the early whorls (the earliest whorls are unknown), with a less pronounced cord between them and the posterior suture, arising on the third or fourth whorl and becoming progressively stronger on the later whorls; entire surface of whorls threaded by very fine revolving lirae, which are especially evident on slightly decorticated individuals. Aperture unknown. Incrementals strongly marked, gently and symmetrically arcuate, occasionally slightly beading the spiral threading.

Dimensions of holotype: Height, 23.0 mm; greatest diameter, 13 mm. The holotype is a very incomplete individual with only about 2½ whorls remaining.

Observations (Bowles 1939): In slightly decorticated individuals the large revolving cords are not obvious, and the numerous small revolving lines comprise the chief sculpture. It was such an individual that Aldrich described from Allenton under the name *Turritella allentonensis*. The smaller specimen that he figured under this name exhibits the characteristic cords much better than does the type, and, although immature, it is much better preserved and more complete than the holotypes of either *M. allentonensis* or *M. wilcoxiana*. Harris (1896) described *M. watsonensis* from a locality near Clayton in Barbour County, Alabama. This species was described from a mold only, and it is apparently only a young specimen of *M. wilcoxiana* very similar to the paratype of *M. allentonensis*.

M. wilcoxiana can be confused only with *M. mavericki* Gardner of the Texas Midway. It differs from the Texas form in the less-marked inflation of its whorls, and in the more gradual tapering of its spire. The revolving cords of *M. mavericki* are more concentrated on the median portion of the whorl than are those of *M. wilcoxiana*. Both these species are very large, larger than any of the other representatives of the genus in the Gulf Eocene or Paleocene.

Observations: Bowles carries this species under the name *wilcoxiana*. We prefer *allentonensis* because it has page precedence and because the former name might be construed to mean that the species occurs in the Wilcox group.

BIPLICATA BOWLES

MESALIA

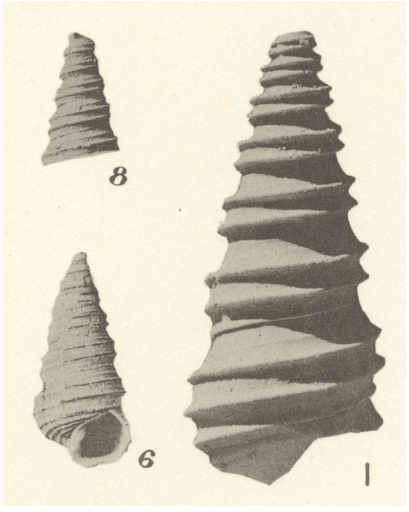


Fig. 6—holotype, X 1,
Fig. 8—paratype, X 2; Bowles 1939.
Fig. 1—topotype, X 3.

Type Data: Holotype No. 494990, paratype No. 494991, U. S. Nat. Mus., Washington, D.C.

Type Locality: Nanafalia Landing on left bank of Tombigbee River west of Nanafalia and 1.7 miles by road above new bridge of State Highway 10, Marengo County, Alabama.

Geologic Horizon: Nanafalia formation, Wilcox group, lower Eocene.

Distribution: Nanafalia formation of Alabama.

Synonymy:

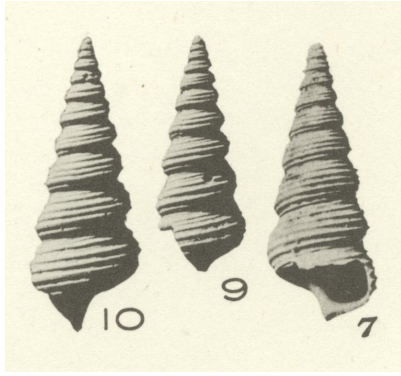
1939 *Mesalia biplicata* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 328, pl. 34, figs. 6, 8.

Original Description: Spire abruptly tapering; whorls rounded, inflated, numerous; sutures distinct but not sharply impressed. Apical whorls marked by two strong revolving cords, on the third or fourth whorl a much less pronounced secondary rib appearing between the posterior primary cord and the posterior suture, and a second indistinct cord appearing a little later between the anterior primary cord and the anterior suture. Unlike the secondary sculpture of *M. alabamiensis* these secondary lirae do not increase materially in size, the adult whorls being strongly bicarinate like the apical. Base of the body whorl marked by five additional strong revolving cords. Incrementals distinct, simple, arcuate, cutting the anterior suture almost directly below their intersection with the posterior suture. Aperture subcircular, the anterior edge of the lip slightly reflected.

Dimensions: Holotype, height, 28.5 mm; greatest diameter, 13.3 mm. Paratype, height, 22.0 mm; greatest diameter, 19.0 mm.

Observations (Bowles 1939): *Mesalia biplicata* differs from *M. alabamiensis* in the persistence of its bicarinate sculpture. The sculpture of *M. alabamiensis* is variable within restricted limits, but the adult whorls always bear either four or five strong, subequal, revolving cords, none of which is as prominent as the two sharp carinations of *M. biplicata*. The early whorls of *M. alabamiensis* exhibit three equal lirae, but the apical whorls of the subspecies have only two.

ALABAMIENSIS BOWLESI STENZEL & TURNER



Figs. 9, 10—syntypes, X 3.
Fig. 7—specimen, X 3, Bowles 1939.

Type Data: Syntypes in Stenzel collection, Austin, Texas.

Type Locality: Graveyard Hill, Wilcox County, Alabama, northwest slope of hill occupied by State Graveyard, southeast quarter sec. 32, T. 12 N., R. 10 E., 3 miles airline distance north of Oakhill, by private road 1.05 mile west of county road and 4.15 miles from Oakhill crossroads; Bureau of Economic Geology locality No. Ala–19.

Geologic Horizon: Sucarnoochee formation, Midway group, Paleocene.

Distribution: Sucarnoochee formation of Alabama and undifferentiated Midway group of Georgia and Arkansas.

Synonymy:

1896 *Mesalia alabamiensis*, Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 227, pl. 12, fig. 1.

1939 *Mesalia pumila*, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 325, 326, pl. 34, fig. 7.

1940 *Mesalia alabamiensis bowlesi* Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 842, 843, pl. 47, figs. 9, 10.

Original Description: Spire high, rather abruptly tapering, although not especially so for the genus. Whorls numerous, rounded, sharply constricted at the linear sutures. Sculpture consisting of two rather prominent revolving cords on the earliest whorls, with accessory revolving cords appearing both anterior and posterior to them on the fourth to the seventh whorls; secondary sculpture increasing rapidly in prominence until on adult whorls it is hardly distinguishable in degree of elevation from the two primary cords. Total number of revolving cords on the adult whorls variable, ranging from five to eight in a rather limited suite of specimens. Growth lines simple, gently arcuate, not reflexed. Aperture unknown.

Observations: This subspecies resembles *M. alabamiensis* (Whitfield) much more closely than it does the figure of the type of *Mesalia pumila* (Gabb) under which name Bowles placed it. *Mesalia alabamiensis* has two faint revolving lirae on the early whorls, has very similar ribs on the adult whorls, and is of the same general character; *M. alabamiensis bowlesi* differs chiefly in having a better marked bilirate stage, more deeply inflected growth lines, more deeply impressed sutures, a tendency to carination of the whorls, and a smaller size.

Prepared by H. B. Stenzel & F. E. Turner, Bureau of Economic Geology, Austin, Texas.

CLAIBORNENSIS HARRIS

MESALIA

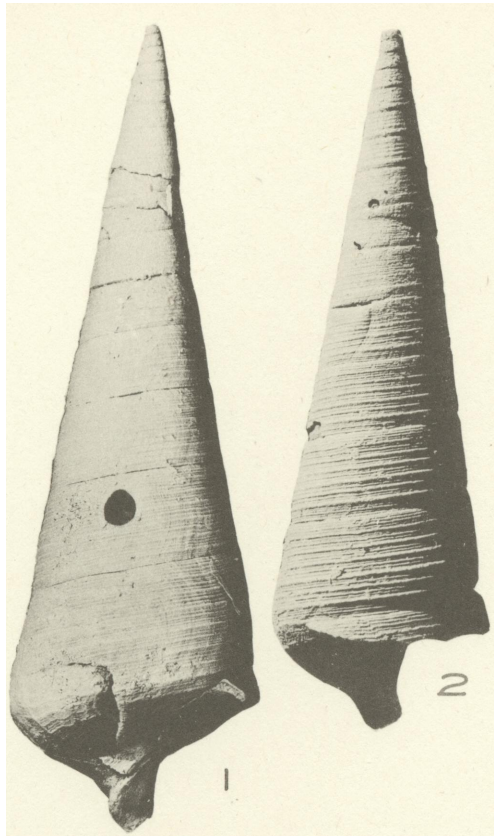


Fig. 1—syntype figured by Harris 1895, X 3,
Fig. 2—syntype, X 3.

Type Data: Eight syntypes No. 1521, Geology Dept., The University of Texas, Austin, Texas.

Type Locality: Stone City (Moseleys Ferry), bluff on right bank of Brazos River at bridge of State Highway 21 and bridge of Southern Pacific Railroad, Burleson County, Texas.

Geologic Horizon: Stone City formation, Claiborne group, middle Eocene.

Distribution: Stone City formation of Texas, Cook Mountain formation of Texas and Louisiana, Lisbon formation of Alabama; all in Claiborne group, middle Eocene. Reported from McBean formation of South Carolina and Georgia and Cook Mountain formation of Mexico (Bowles 1939). Not found in formations below the Stone City beds.

Synonymy:

1895 *Mesalia claibornensis* Conrad (MS), Harris, G. D., New and otherwise interesting Tertiary Mollusca from Texas: Acad. Nat. Sci. Philadelphia, Proc. for 1895, p. 80, 81, pl. 9, fig. 5.

1937 *Mesalia claibornensis*, Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 206–208, pl. 27, figs. 9, 10, 16.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 328–331, pl. 34, fig. 5.

Original Description: Size and general form as indicated by the figure; whorls about 15; sides of the whorls nearly rectilinear; sides of the spire taken as a whole slightly concave; surface of each whorl ornamented by spiral lines of three sizes, of which there are from five to seven of the first and second, and double that number of the third magnitude, the latter are mere striae; lines of growth faint or obscure; suture well defined but very narrow.

This species is similar in some respects to Conrad's *Mesalia vetusta*, but can at once be distinguished by the following differences: *claibornensis* has two or three more whorls; the sides of the spires are concave and not convex as in that of *vetusta;* the suture is less distinctly marked by a shoulder below it; there is a total lack of those strong lines or folds of growth so characteristic of *vetusta;* the lower angulation of the body whorl is more sharply defined.

Observations: Sides of spire may be straight as well as concave in profile. The aperture has a short twisted anterior canal. Sculpture of apical whorls on *M. claibornensis* s.s. from Stone City: 3 spirals on third whorl, 4 on fourth, anterior spiral slightly stronger, posterior two or three weaker and nearly uniform. On specimens from formations above the Stone City 3 prominent spirals continue down 6 or more whorls with the anterior two the stronger.

Posterior spiral begins bifurcating at about this point. Meanwhile finer spirals appear between the original three. Adult spiral ribbing in topotypes very nearly uniform with finer intervening threads. On specimens from formations above the Stone City formation with the three ribbed adolescent whorls the adult ribbing tends to be more unequal while retaining the finer threads between. Arcuate cancellations of growth lines and slight separation of whorls as seen in holotype are rare in the Stone City formation and rarer in higher formations. Above the Stone City the profile of the whorls is more variable, occasionally with lower portion inflated and upper base overhanging slightly. *M. vetusta* Conrad may be distinguished by its convex profile and more rounded base; *M. wilcoxiana* (Aldrich) by the bunching of the ribbing; *M. mavericki* Gardner, *M. pumila* (Gabb), by their coarser and more prominent spiral ribbing. According to Bowles *M. georgiana* is distinguished by its finer spiral ribbing.

GEORGIANA BOWLES

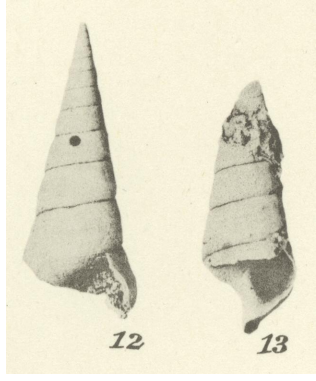


Fig. 12—paratype,
Fig. 13—holotype; Bowles 1939.

Type Data: Holotype No. 498008, paratype No. 498007, U. S. Nat. Mus., Washington, D.C.

Type Locality: Seven and one-half miles southeast of Louisville, Jefferson County, Georgia. Paratype from 9 miles southeast of Louisville, Jefferson County, Georgia.

Geologic Horizon: Barnwell formation, Jackson group, upper Eocene.

Distribution: Reported only from the Barnwell formation of Georgia.

Synonymy:

1939 *Mesalia georgiana* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 324, 333, pl. 34, figs. 12, 13.

Original Description: Spire high, robust, abruptly tapering. Sutures linear, distinct, not deeply impressed; much more comparable to the sutures of *M. claibornensis* than to those of *M. vetusta.* Apical whorls not well preserved, but apparently smooth or sculptured only by extremely fine lines; adolescent whorls marked by numerous very fine subequal revolving lines, which increase in strength but slightly with the growth of the shell; 23 of these faint revolving subequal lirae, hardly discernible to the naked eye on the adult. Incrementals distinct, but not prominent, gently arcuate, first appearing at about the same time as the spiral sculpture. Outer lip very thin and fragile, not preserved entire on any of the specimens. Columella slightly reflected basally in a shallow but distinct spoon.

Dimensions: Holotype, height, 33.5 mm; greatest diameter, 13.5 mm. Paratype, height, 39.5 mm; greatest diameter, 15.5 mm. The holotype is broken at the tip and the edge of the outer lip, and the paratype does not have the aperture preserved.

Observations (Bowles 1939): This species most closely resembles *Mesalia claibornensis* Harris of the Claiborne. As a rule the specimens are larger, however, and the sculpture pattern is quite distinct. The numerous very fine subequal revolving lines distinguish this form from any other in the Eocene of the Gulf Province. The outline of the shell, the fine sculpture, and the lack of shouldering of the whorls separate *M. georgiana* from the Jackson *M. vetusta.*

This species is probably referable to the *wilcoxiana-alabamiensis-claibornensis* strain and, with *vetusta* marks the culmination of that virile race.

GOMIN BOWLES

MESALIA

Fig. 9—holotype, X 2, Bowles 1939.

Type Data: Holotype No. 497954, U. S. Nat. Mus., Washington, D.C.

Type Locality: Descent to the valley of the Wateree River, 2 miles west of Catchall and 4 miles northeast of Claremont, Sumter County, South Carolina. Compare Cooke, C. W., Geology of the Coastal Plain of South Carolina: U. S. Geol. Survey Bull. 867, p. 51, 1936.

Geologic Horizon: Black Mingo formation, Midway group, Paleocene. The fossil was found in red argillaceous sand.

Distribution: Black Mingo formation of South Carolina.

Synonymy:

1939 *Mesalia gomin* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 326, 327, pl. 33, fig. 9.

Original Description: Shell small; spire abruptly tapering. Whorls (only four preserved on the holotype) inflated, angulated somewhat by the prominent revolving carinae. Sculpture the same on all the whorls preserved, consisting of three prominent revolving carinae, the posterior one less pronounced than the two subequal anterior; fine revolving lines are also present over the surface of the whorls, but they are obscured by the prominent overriding growth lirae. Incrementals simple arcs, strongly marked. Outer lip not preserved.

Dimensions: Holotype, height, 12.5 mm; greatest diameter, 7.5 mm. The holotype is broken both at the apex and the aperture.

Observations (Bowles 1939): This species differs from *Mesalia alabamiensis* (Whitfield) of the Alabama Wilcox in the persistence of the three prominent revolving lirae on the adult whorls. *M. alabamiensis* exhibits three revolving cords on the earliest apical whorls, but others are added early and the adult whorls are characteristically marked by four or five prominent subequal revolving carinae. The other lower Wilcox form of Alabama, *M. biplicata*, differs from *M. gomin* in the persistence of only two of the apical ribs onto the adult whorls. *M. wilcoxiana* and *M. mavericki* of the lower Midway are more robust forms with stronger cords, and with fairly prominent secondary sculpture on the adult whorls.

HARDEMANENSIS (GABB)

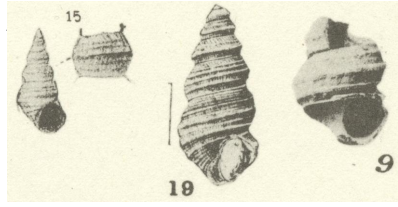


Fig. 15—Gabb 1860.
Fig. 19—syntype of Gabb 1860, refigured by Harris 1896.
Fig. 9—topotype, Bowles 1939.

Type Data: Several syntypes in collection of J. M. Safford, Vanderbilt Univ., Nashville, Tennessee, according to Harris 1896. Could not be located by Bowles 1939.

Type Locality: Branch of Cypress Creek, 2 miles south or southeast of Middleton, near the old stage road, southeastern Hardeman County, Tennessee.

Geologic Horizon: Clayton formation, Midway group, Paleocene.

Distribution: Midway group of Tennessee and Mississippi.

Synonymy:

1860 *Turritella hardemanensis* Gabb, W. M., Descriptions of new species of American Tertiary and Cretaceous fossils: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 4, p. 392, pl. 68, fig. 15.

1896 *Mesalia pumila* var. *hardemanensis*, Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 226, 227, 228, pl. 21, fig. 19.

1939 *Mesalia hardemanensis*, Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 333, 334, pl. 34, fig. 9.

Original Description: Turrited; whorls seven, strongly carinated at the middle; mouth rounded; surface marked by two or three large ribs below the carina and two above.

Dimensions: Length, .6 in., width of body whorl .27 in., length of mouth .2 in.

Observations (from Bowles 1939): Sculpture consisting of a very prominent medial carina on the early whorls, with an accessory cord posterior to it and another anterior to it arising on the adolescent whorls and gradually becoming more prominent; the median carina on the adult whorls more or less flat-topped, with slightly rounded margins, not sharp as in *Turritella postmortoni* Harris and *T. praecincta* Conrad; finer lines occasionally appearing on the adult whorls, variously placed with respect to the median carina and the anterior and posterior accessory cords. Incrementals distinct, simple, gently arcuate not reflexed. This is the only medially carinate *Mesalia* found in the Eastern Gulf Embayment.

Mesalia sayi Bowles exhibits the medial carina only on the apical whorls, and the revolving cord is relatively not so wide, nor does it have the rounded edges and flat top that distinguish the carina of *M. hardemanensis*.

MAVERICKI GARDNER

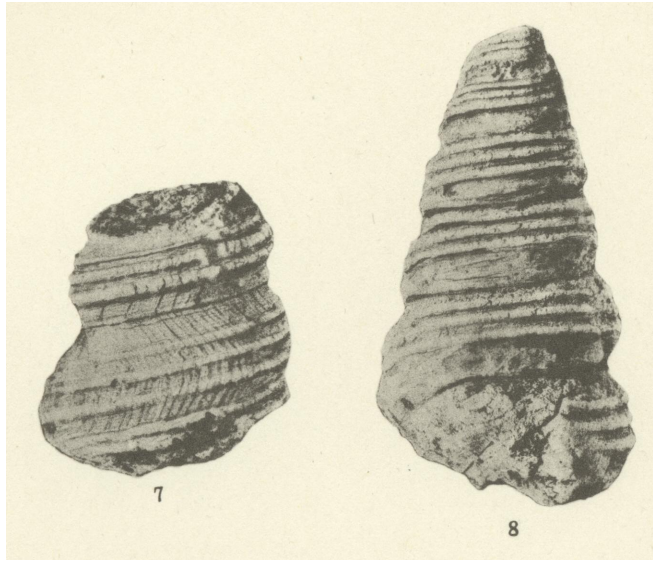


Fig. 7—paratype, X 2,
Fig. 8—holotype, X 2; Gardner 1935.

Type Data: Holotype No. 370944, U. S. Nat. Mus., Washington, D.C.

Type Locality: Six miles south of the McFarland sheep pens and 27 miles southeast of Eagle Pass on the Windmill (Jacal) ranch road, near headwaters of Cuero Creek, approximately 5½ miles east-northeast of San Antonio crossing of Rio Grande, Maverick County, Texas.

Geologic Horizon: Surface shingle of "red beds," upper Kincaid formation, Midway group, Paleocene.

Distribution: Wills Point and Kincaid formations, Midway group, Paleocene, of Texas.

Synonymy:

1935 *Mesalia mavericki* + *M.* cf. *mavericki* Gardner, J. A., The Midway group of Texas: Univ. Texas Bull. 3301, p. 295, 296, pl. 25, figs. 7, 8.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 325.

Original Description: A few coils of a rather large coarse species with inflated, rapidly enlarging whorls were collected from the weathered greensands, 27 miles southeast of Eagle Pass. The species is strongly reminiscent of *Mesalia wilcoxiana* Aldrich and, like it, is wound with three prominent spiral cords. The Maverick County species tapers more rapidly, however, than that from Wilcox County, Alabama, the spirals are stronger, relatively more elevated, though perhaps not so broad, and are more concentrated toward the medial portion of the whorl. The secondary spiral liration which covers the entire surface from suture to suture is finer in the Texas species and sharper. An incremental sculpture reticulates the secondary spirals and at regular intervals strengthens into tiny axials which are bent backwards between the sutures in a broad arc, the axis of which is the periphery of the whorl. The apertural features, unfortunately, have not been preserved.

Dimensions.—Diameter of whorl, 17.0 millimeters.

Observations: The geologic horizon of this species was given by Gardner 1935 as Wills Point formation, but Bowles 1939 gave Kincaid formation. The geologic map of Texas 1937 shows in southern Maverick County, Kincaid formation only.

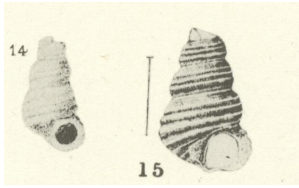


Fig. 14—syntype,Gabb 1860.
Fig. 15—syntype of Gabb 1860 refigured by Harris 1896.

Type Data: Collection of J. M. Safford, Vanderbilt Univ., Nashville, Tennessee, according to Harris 1896; could not be located by Bowles 1939.

Type Locality: Two miles south or southeast of Middleton, on a branch of Cypress Creek and near the old stage road, southeastern Hardeman County, Tennessee (compare Safford, J. M., Geology of Tennessee, p. 419, 1869).

Geologic Horizon: Clayton formation, Midway group, Paleocene.

Distribution: Clayton formation, Midway group, of Tennessee.

Synonymy:

1860 *Turritella pumila* Gabb, W. M., Descriptions of new species of American Tertiary and Cretaceous fossils: Acad. Nat. Sci. Philadelphia Jour., ser. 2, vol. 4, p. 392, pl. 68, fig. 14.

1896 *Mesalia pumila,* Harris, G. D., The Midway stage: Bull. Am. Paleontology, vol. 1, p. 226, pl. 21, fig. 15.

1939 Not Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 325, 326, pl. 34, fig. 7 = *Mesalia alabamiensis bowlesi* Stenzel & Turner.

Original Description: Turrited, whorls? (spire is broken) rounded and strongly striate; mouth round; shell very thick; surface marked by three heavy revolving lines on the convexity of the whorl, and one at the base just above the suture, which is small but distinct.

Dimensions: Length of fragment .5 in., width of body whorls .3 in., diameter of mouth .1 in.

Observations: The best figure of this species is given by Harris 1896 who refigured Gabb's type. The illustration shows a very thick shell with 3 ribs on the spire whorls. *Mesalia alabamiensis bowlesi* Stenzel & Turner is thin-shelled and has 5 to 8 ribs.

SAYI BOWLES

MESALIA

Fig. 6—holotype, X 1½, Bowles 1939.

Type Data: Holotype No. 494798, paratype No. 494799, U. S. Nat. Mus., Washington, D.C.

Type Locality: On the road from Rancho Durazno to Rancho las Flores, 520 meters southeast of crossing of east-west brecha, Nuevo León, Mexico.

Geologic Horizon: Lower Wilcox group, lower Eocene.

Distribution: Lower Wilcox of Nuevo León, Mexico.

Synonymy:

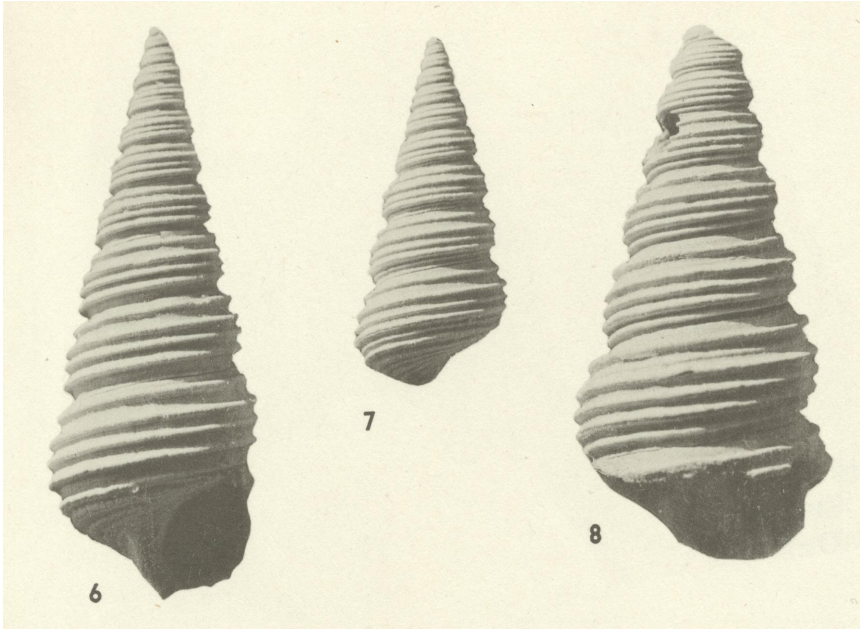
1939 *Mesalia sayi* Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 334, 395, pl. 33, fig. 6.

Original Description: Spire abruptly tapering. Sutures distinct, deeply impressed and slightly overhung on the adolescent whorls where the revolving cords just posterior to the suture become very pronounced. Apical whorls marked only by a strong revolving medial carination. A secondary revolving cord appears posterior to this primary carination on the second or third whorl, more secondary cords added posterior to the carination on the few succeeding whorls, until on the adult whorls there are three or four, gradually increasing in strength with the growth of the shell. Incrementals deeply arcuate, but simple and not reflected. Aperture unknown.

Dimensions: Holotype, height, 18.0 mm; greatest diameter, 12.0 mm. Paratype, height, 8.0 mm; greatest diameter, 4.5 mm. Both the holotype and the paratype are incomplete specimens.

Observations (Bowles 1939, abbreviated): The closest analogue of this species is *M. hardemanensis* (Gabb) of the Porters Creek clay of Mississippi and Tennessee. *Mesalia hardemanensis* has more rounded whorls than *M. sayi*, and it never shows the numerous secondary revolving cords that are so characteristic of the adult whorls of the Mexican form.

ALABAMIENSIS TETRADEIRAS STENZEL & TURNER



Figs. 6–8—Syntypes, X 3.

Type Data: Syntypes in Stenzel collection, Austin, Texas.

Type Locality: Bells Landing on left bank of Alabama River, west of Tinela, Monroe County, Alabama.

Geologic Horizon: Bells Landing marl, Tuscahoma formation, Wilcox group, lower Eocene.

Distribution: Bells Landing marl, Tuscahoma formation of Alabama.

Synonymy:

1890 *Potamides alabamiensis,* De Gregorio, A., Monographie de la faune Éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 124, pl. 11, fig. 13a(?).

1940 *Mesalia alabamiensis tetradeiras* Stenzel, H. B., & Turner, F. E., Turritellidae from the Paleocene and Eocene of the Gulf Coast: Univ. Texas Pub. 3945, p. 843, pl. 47, figs. 6–8.

Original Description: Shell medium in size; apical angle 30°–35° on early whorls, 22°–25° on adult whorls; earliest whorls bilirate; adult whorls with usually 4, rarely 5, strong narrow elevated revolving ribs, which are sharp crest-like except for the fourth from the posterior suture. This rib is high and flat-topped. Interspaces with exceedingly fine striae; slightly stronger striae between the anterior suture and the most anterior rib. The space at the sutures appears excavated because it lacks the crest-like ribs. Whorls convex.

Observations: This species is very similar to *M. alabamiensis* (Whitfield) differing chiefly in having 4 to 5 revolving ribs instead of seven. *Mesalia alabamiensis bowlesi* Stenzel & Turner is a smaller species with a better marked bilirate stage and a tendency to an obscure angulation of the whorls.

The subspecific name is derived from the Greek τέτρα, four, and δειράς, ridge, and refers to the four large revolving ribs.

VETUSTA (CONRAD)

MESALIA

Fig. 1—topotype, X 2, Bowles 1939.

Type Data: Lectotype in Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania.

Type Locality: Claiborne Bluff, left bank of Alabama River, Monroe County, Alabama.

Geologic Horizon: Gosport sand, Claiborne group, middle Eocene.

Distribution: Gosport sand of Alabama.

Synonymy:

1833 *Melania? vetusta* Conrad, T. A., Fossil shells of the Tertiary formations of North America, p. 35.

1833 *Cerithium striatum* Lea, Isaac, Contributions to geology, p. 131, 132, pl. 4, fig. 122.

1835 *Turritella vetusta* Conrad, T. A. [republication of Conrad 1833], p. 40, pl. 15, fig. 13.

1890 *Cerithium (Cerithidea) vetustum*, de Gregorio, A., Monographie de la faune Éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 117, pl. 10, figs. 18–21.

1895 *Mesalia vetusta*, Harris, G. D., Claiborne fossils: Bull. Am. Paleontology, vol. 1, p. 43, 48, 50, pl. 1, fig. 6.

1937 Palmer, K. Van W., The Claibornian Scaphopoda, Gastropoda and dibranchiate Cephalopoda of the southern United States: Bull. Am. Paleontology, vol. 7, p. 205–207, pl. 27, figs. 7, 8, 13–15.

1939 Bowles, Edgar, Eocene and Paleocene Turritellidae of the Atlantic and Gulf Coastal Plain of North America: Jour. Paleontology, vol. 13, p. 331–333, pl. 34, fig. 1.

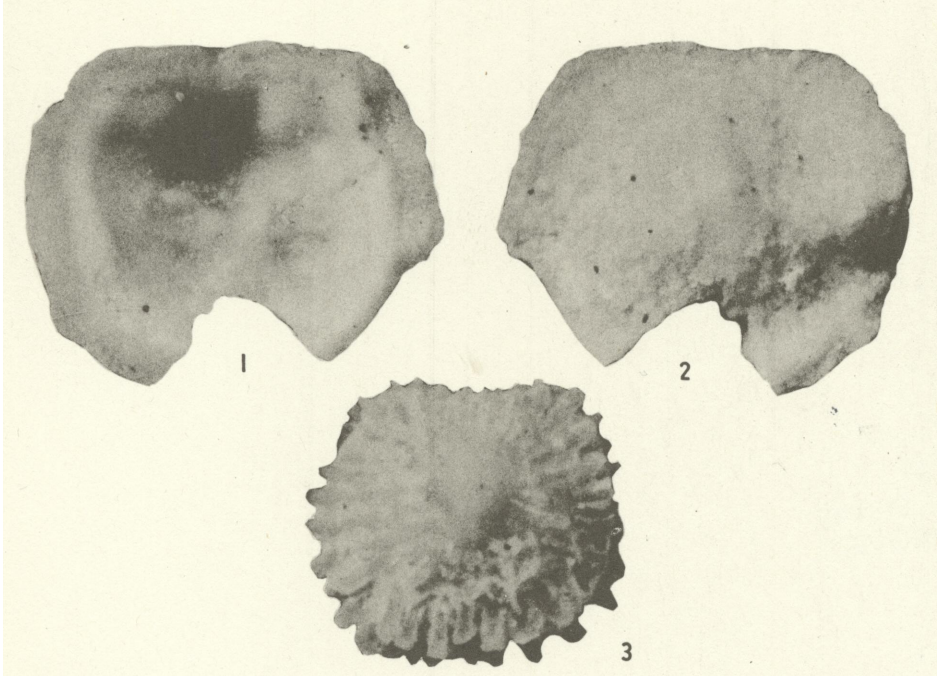
Original Description: Shell turrited, acute, with numerous revolving, slightly elevated lines, alternately larger and smaller, and longitudinal minute, much arcuated wrinkles: suture obvious, not deeply impressed: canal patulous; aperture about one-fourth of the length.

Length 1¼ inches.

Observations: Apical angle variable; first two or three whorls smooth, very fine revolving lines appearing on the third or fourth whorl, becoming numerous on adult whorls. Occasional specimens have a slight shoulder anterior to the suture, some have rounded and some straight-sided whorls. This species differs from *M. claibornensis* Harris in its convex shell profile and better developed arcuate ribs following the growth lines. *Mesalia georgiana* is generally larger and has finer almost invisible spirals.

SP. TOULMIN

CRANIA?



Figs. 1, 2—interior and exterior of dorsal valve, X 18,
Fig. 3—exterior of dorsal valve, X 20.

Type Data: Two specimens, Nos. 50742, 50743, Geology Dept., Princeton University, Princeton, New Jersey.

Type Locality: 48 feet below top of Salt Mountain, about 6 miles south of Jackson, Clarke County, Alabama, southwest ¼ of southwest ¼ of sec. 34, T. 6 N., R. 2 E. (figs. 1, 2). Spring, ½ mile north of Salt Mountain (fig. 3).

Geologic Horizon: Salt Mountain limestone, Wilcox group, lower Eocene.

Distribution: Known only from type locality.

Synonymy:

1940 *Crania?* sp. Toulmin, L. D., Eocene brachiopods from the Salt Mountain limestone of Alabama: Jour. Paleontology, vol. 14, p. 228, pl. 28, figs. 1–3.

Original Description: Dorsal valve small, about as wide as long, conical, flattened posteriorly and anteriorly from the apex to the margin. Apex prominent, subcentral. Outline subcircular, posterior margin straight, lateral and front margins gently rounded. Test with radiating costellae becoming increasingly spinose away from the apex. Interior of dorsal valve with border around the margin of the valve. Inner limit of the border marked by rounded raised ridge surrounding the interior. Posterior adductor pedestals slightly raised, rounded, near the posterior border within the inner angles of the posterior raised ridge. Anterior adductor pedestals near center of the valve, consisting of two short oblique elevations diverging posteriorly. A similarly shaped elongate prominence in the median line is directed anteriorly from its juncture with the anterior adductor pedestals. Impressions of pallial sinuses in the anterior portion of the valve not seen.

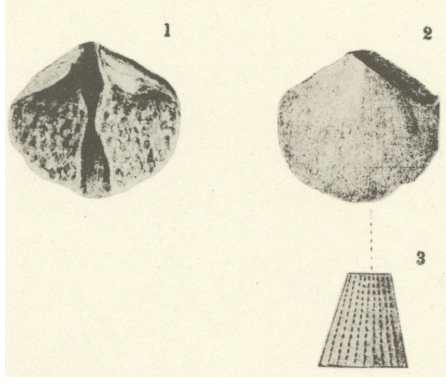
Dimensions of illustrated specimen, figs. 1, 2: Length, 3.00 mm; width, 3.42 mm.

Original Observations: Dorsal valves of a species of spiny *Crania* are common in the Salt Mountain limestone. A single specimen was observed that showed clearly the muscular impressions. The dorsal valve of this specimen is illustrated. The dorsal valves of *Crania?* sp. are often irregular in shape as a result of the ventral valve being attached to an uneven surface.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

CLAIBORNENSIS DE GREGORIO

THECIDEA?



Figs. 1, 2—interior and exterior,
Fig. 3—detail of surface enlarged; de Gregorio 1890.

Type Data: Monotype (pedicle valve) presumably in De Gregorio home, via Molo 132, Palermo, Italy.

Type Locality: Presumably Claiborne Bluff on left bank of Alabama River, Monroe County, Alabama.

Geologic Horizon: Presumably Gosport sand, Claiborne group, middle Eocene.

Distribution: Only one specimen known.

Synonymy:

1890 *Thecidea?* sp. = *Thecidea claibornensis* de Gregorio, Antoine, Monographie de la faune Éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 238–239, pl. 39, figs. 1–3.

Original Description (translated): Shell elliptic—triangular, thick, umbonal valve spongy inside and in the middle divided by a very deep sulcus, outside very finely punctate under the magnifying lens; foramen wide; deltidium very wide; cardinal area narrow and suberect on both sides.

Remarks: De Gregorio expressed doubts about the provenance of this specimen. However, the matrix and color of the specimen are said to agree with those from the Gosport sand. No additional material is known. A restudy of the specimen is needed.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

COOPERI TOULMIN

Fig. 4—interior of dorsal valve, holotype, X 30,
Fig. 5—dorsal view of shell, paratype, No. 50745, X 20,
Fig. 6—interior of ventral valve, paratype, No. 50746, X 20,
Fig. 7—mold of interior of dorsal valve on ventral valve, paratype 1, X 30,
Fig. 8—dorsal valve, paratype 2, X 20,
Figs. 9–11—dorsal valves with median septum, paratypes 3–5, X 30.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

THECIDELLINA

Synonymy:

1940 *Thecidellina cooperi* Toulmin, L. D., Eocene brachiopods from the Salt Mountain limestone of Alabama: Jour. Paleontology, vol. 14, p. 228–229, pl. 28, figs. 4–11.

Original Description: Shell small, thick, rostrate, subtrigonal in outline. Hinge line straight, shorter than the greatest width of the shell. Ventral valve attached by the ventral surface of the beak. Surface of valves marked by concentric growth lines only. Beak produced, callous on the ventral side irregular because of variation in the position and proportions of the attached surface. Cardinal area of the beak large, triangular, flat.

Ventral valve very convex, deep, thickened. Hinge teeth stout, cylindrical protuberances projecting forward from the cardinal margin on each side of a rectangular open space in the cardinal area of the beak. Beak hollow. Other structures on the interior of the ventral valve unknown. Septum not seen.

Dorsal valve subcircular, with straight hinge line. Greatest width of dorsal valve near the middle or just forward of the middle. Dorsal surface nearly flat to gently convex, becoming more strongly convex in the middle of the valve toward the umbo. Socket ridges uniting medianly and projecting posteriorly to form a prominent rectangular cardinal process. Dental sockets consisting of a pair of small, round, deep depressions dorsal to the cardinal process and on each side of it. Interior of dorsal valve surrounded by a broad, raised, outwardly sloping granulated margin, and divided medianly by a strong high septum. Septum extending posteriorly from the granulated anterior margin, becoming higher posteriorly, and reaching nearly to the bridge that crosses the posterior portion of the valve. Anteriorly the edges of the septum join with the inner edges of the granulated margin in a smooth curve enclosing the oval brachial furrows. Granulated margin on each side of the valve continuing posteriorly to the cardinal margin, stopping just outside the dental sockets near the extremities of the hinge line. The raised inner edge of the margin continuing as a high thin ridge in a smooth curve across the posterior portion of the valve, forming a bridge at the forward end of the cardinal process. The keel-like bridge is penetrated by a pair of small round holes ventral to the cardinal process. The depression on each side of the valve between the septum and the margin is occupied by an oval-shaped area deepened in the middle and surrounded by a serrate edge roughly parallel to the inner edge of the granulated margin and septum.

The high posterior end of the septum is not attached directly to the inner surface of the dorsal valve but is separated from it by a hollow space or cavity in the posterior portion of the valve. The shell matter covering this cavity, including the posterior end of the septum and the bridge, is destroyed in many of the specimens. Three depressions are then present in the interior of the dorsal valve, one on each side of the short remaining part of the septum and the other situated medianly in the posterior half of the valve.

Dimensions of dorsal valve of holotype: Length, 1.83 mm; width, 2.02 mm.

Original Remarks: *Thecidellina cooperi* closely resembles *T. barretti* Davidson but differs from it in having the septum thinner and higher at the posterior end. *Thecidellina cooperi* is common throughout the Salt Mountain limestone. It is named in honor of Dr. G. A. Cooper of the United States National Museum.

Type Data: Holotype, No. 50744, and paratypes, Nos. 50745, 50746, Geology Dept., Princeton University, Princeton, New Jersey. Paratypes 1–5, Alabama Mus. Nat. History, University, Alabama.

Type Locality: 10 to 30 feet below top of Salt Mountain, about 6 miles south of Jackson, Clarke County, Alabama, southwest ¼ of southwest ¼ of sec. 34, T. 6 N., R. 2 E.

Geologic Horizon: Salt Mountain limestone, Wilcox group, lower Eocene.

Distribution: Known only from type locality.

SP. TOULMIN

CRYPTOPORA?

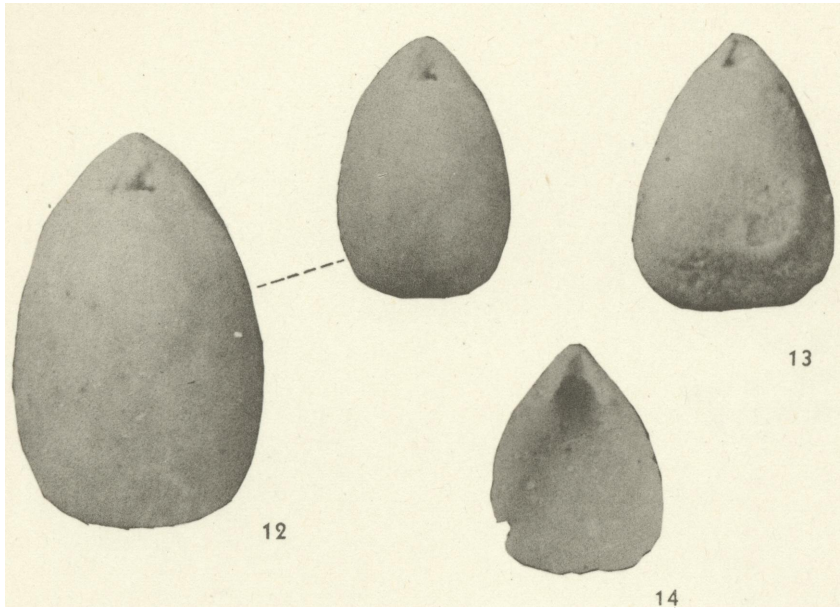


Fig. 12—dorsal view of shell, X 30,
Fig. 12—dorsal view of shell, X 20,
Fig. 13—dorsal view of shell with wide anterior end, X 20,
Fig. 14—interior of ventral valve, X 20.

Type Data: Three specimens, Nos. 50747–50749, Geology Dept., Princeton University, Princeton, New Jersey.

Type Locality: On Jackson-Rockville road 300 feet southeast of Salt Mountain (fig. 12), hill top 3000 feet south of Salt Mountain (fig. 13), and 26 feet below top of Salt Mountain (fig. 14), about 6 miles south of Jackson, Clarke County, Alabama.

Geologic Horizon: Salt Mountain limestone, Wilcox group, lower Eocene.

Distribution: Known only from type locality.

Synonymy:

1940 *Cryptopora?* sp. Toulmin, L. D., Eocene brachiopods from the Salt Mountain limestone of Alabama: Jour. Paleontology, vol. 14, p. 229–230, pl. 28, figs. 12–14.

Original Description: Shell minute, thin and delicate, suboval in outline, tapering posteriorly. Greatest width of shell generally forward of the midline. Anterior margin bluntly rounded. Valves biconvex. Dorsal valve less strongly convex than the ventral. Test smooth, with faint growth lines on the dorsal valve. Anterior commissure rectimarginate. Hinge line short, curved. Beak short, straight. Deltidial plates rudimentary. Interior of ventral valve with low pedicle collar, not supported by a median septum. Hinge teeth small, supported by divergent dental plates.

Dimensions of illustrated specimen, fig. 12: Length, 1.77 mm; width, 1.17 mm.

Original Remarks: There is some question about assigning this form to *Cryptopora* inasmuch as the internal structures of the dorsal valve have not been seen. It is not known whether or not a median septum is present. There was no indication of a median septum in two individuals which were sectioned. Short divergent dental plates were revealed in a section of a complete specimen but were not observed in any of the loose ventral valves.

This small shell bears a close resemblance to the exterior of *Cryptopora gnomon* Jeffreys, the type species of the genus, but is more strongly biconvex, and the anterior commissure is straight, not sulcate. The beak is perfectly straight, not incurved as in figures of *C. gnomon*. It is similar to *Cryptopora brazieri* Davidson in dorsal view, and the beak of the latter is straight, but *C. brazieri* is much flatter than the Salt Mountain form.

Cryptopora? sp. is fairly common in the Salt Mountain limestone.

No Tertiary species of *Cryptopora* have been described from North America. *C. gnomon* and *C. brazieri* are Recent species living in the North Atlantic and South Pacific, respectively.

SP. TOULMIN

RHYNCHONELLID?

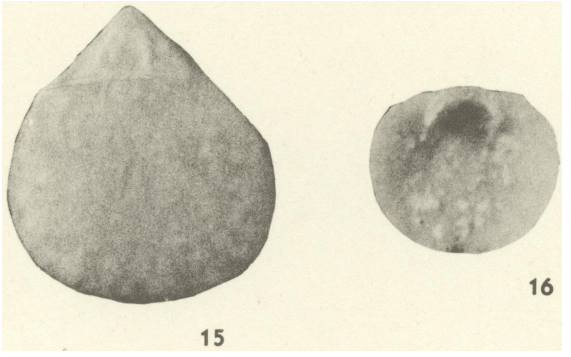


Fig. 15—dorsal view of shell, X 30,
Fig. 16—interior of dorsal valve, X 20.

Type Data: Two specimens, Nos. 50758 (fig. 15), 50759 (fig. 16), Geology Dept., Princeton University, Princeton, New Jersey.

Type Locality: Gully near base of high hill, 2¼ miles south of Salt Mountain, northwest ¼ of northeast ¼ of sec. 16, T. 5 N., R. 2 E. (fig. 15), and 30 feet below top of Salt Mountain (fig. 16), about 6 miles south of Jackson, Clarke County, Alabama.

Geologic Horizon: Salt Mountain limestone, Wilcox group, lower Eocene.

Distribution: Known only from type locality.

Synonymy:

1940 *Rhynchonellid?* sp. Toulmin, L. D., Eocene brachiopods from the Salt Mountain limestone of Alabama: Jour. Paleontology, vol. 14, p. 230, pl. 28, figs. 15, 16.

Original Description: Shell minute, thin, subcircular in outline, about as wide as long. Valves biconvex, becoming somewhat flattened toward the margin. Dorsal valve uniformly convex, slightly less convex than the ventral valve. Ventral valve strongly convex posteriorly beneath the beak. Anterior commissure rectimarginate. Cardinal area trigonal. Hinge line straight. Beak short, straight, with posterior tip erect. Deltidial opening subtrigonal. Foramen apparently hypothyrid, almost submesothyrid. Test smooth or with indication of two or more very faint striae on the dorsal valve diverging anteriorly. Very small shallow circular depression at the cardinal margin of the dorsal valve. Interior of dorsal valve without median septum.

Dimensions of illustrated specimen, fig. 15: Length, 1.38 mm; width, 1.26 mm.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

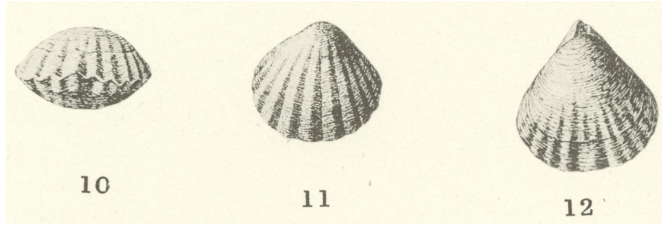


Fig. 10—anterior view,
Fig. 11—haemal valve of adult, latitude 10.0 mm.,
Fig. 12—young, beak slightly defective, altitude 7.0 mm.; Dall 1903.

Type Data: Types in U. S. Nat. Mus., Washington, D.C.

Type Locality: City rock quarry, east side of Wilmington, New Hanover County, North Carolina.

Geologic Horizon: Castle Hayne limestone, Jackson group, upper Eocene.

Distribution: Known only from type locality.

Synonymy:

1903 *Rhynchonella Holmesii* Dall, W. H., Contributions to the Tertiary fauna of Florida with especial reference to the Silex beds of Tampa and the Pliocene beds of the Calooshahatchie River, etc.: Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1536, pl. 58, figs. 10–12.

1926 Kellum, L. W., Paleontology and stratigraphy of the Castle Hayne and Trent marls in North Carolina: U. S. Geol. Survey Prof. Paper 143, p. 33.

Original Description: Shell small, rounded trigonal when young, much more transverse when adult, smooth near the beaks, plicate in front and over most of the valves; the ventral valve with a small, erect beak with a moderate foramen, the deltidial plates united in front of it; anteriorly the margin is slightly, convexly flexuous, the valve evenly, uniformly, radially sculptured with twelve to fourteen subequal rounded ribs with narrower interspaces; haemal valve more convex, reciprocally plicate; the ventral valve has no median septum, but the presence of a hard matrix prevents inspection of the interior characters. Length of haemal valve of an adult 9.5, breadth 11.0, diameter 5.0 mm.; of a ventral valve, length 10.5, breadth 11.5, diameter 3.0 mm.

The specimen figured is a young shell, the adults being more or less fragmentary. It is named in honor of Dr. F. S. Holmes, to whom are chiefly due the fine monographs on the Post-Miocene fauna of South Carolina.

Observations: Rhynchonella holmesii Dall and *Rh. salpinx* Dall have the same type locality. The former species is more finely and evenly plicate than the latter.

Figs. 5–7—Dall 1903.
a, the line of junction of the deltidial plate with the valve.

Type Data: Types in U. S. Nat. Mus., Washington, D.C.

Type Locality: City rock quarry, east side of Wilmington, New Hanover County, North Carolina.

Geologic Horizon: Castle Hayne limestone, Jackson group, upper Eocene.

Distribution: Known only from type locality.

Observations (Thomson 1927): This is an aberrant form amongst Rhynchonellids, the shell being dorsally quadriplicate—*i.e.*, narrowly biplicate, with two small lateral folds. The foramen, according to the figure, is mesothyrid, but the description suggests rather a hypothyrid or submesothyrid auriculate foramen—"the deltidial plates approach to form an arch, unite in the median line and project with flaring edges distally, thus forming a tube in which the peduncle is enclosed and to which the beak of the ventral valve contributes a relatively small portion" (Dall, 1903).

In 1915 I suggested that this species was possibly not a Rhynchonellid, but the auriculate foramen is certainly a Rhynchonelloid and not a Terebratuloid character. Dall (1920) compares the species with his *Hemithyris sladeni*, which I have above tentatively referred to *Aetheia*.

Probably the species must be assigned to a new genus.

Synonymy:

1903 *Rhynchonella salpinx* Dall, W. H., Contributions to the Tertiary fauna of Florida with especial reference to the Silex beds of Tampa and the Pliocene beds of the Caloosahatchie River, etc.: Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1535–1536, pl. 58, figs. 5–7.

1926 Kellum, L. W., Paleontology and stratigraphy of the Castle Hayne and Trent marls in North Carolina: U. S. Geol. Survey Prof. Paper 143, p. 33.

1927 Thomson, J. A., Brachiopod morphology and genera (Recent and Tertiary): New Zealand Board of Sci. and Art, manual 7, p. 59, 74, 163.

Original Description: In the first of the following species (and possibly in both) the deltidial plates approach each other to form an arch, unite in the median line, and project with flaring edges distally, thus forming a tube in which the peduncle is enclosed and to which the beak of the ventral valve contributes a relatively small portion. This arrangement is so different from that which obtains in *Hemithyris* that I hesitate to include the species under that name, but, since the internal characters are not accessible, prefer to list it under *Rhynchonella* until more information shall be obtainable.

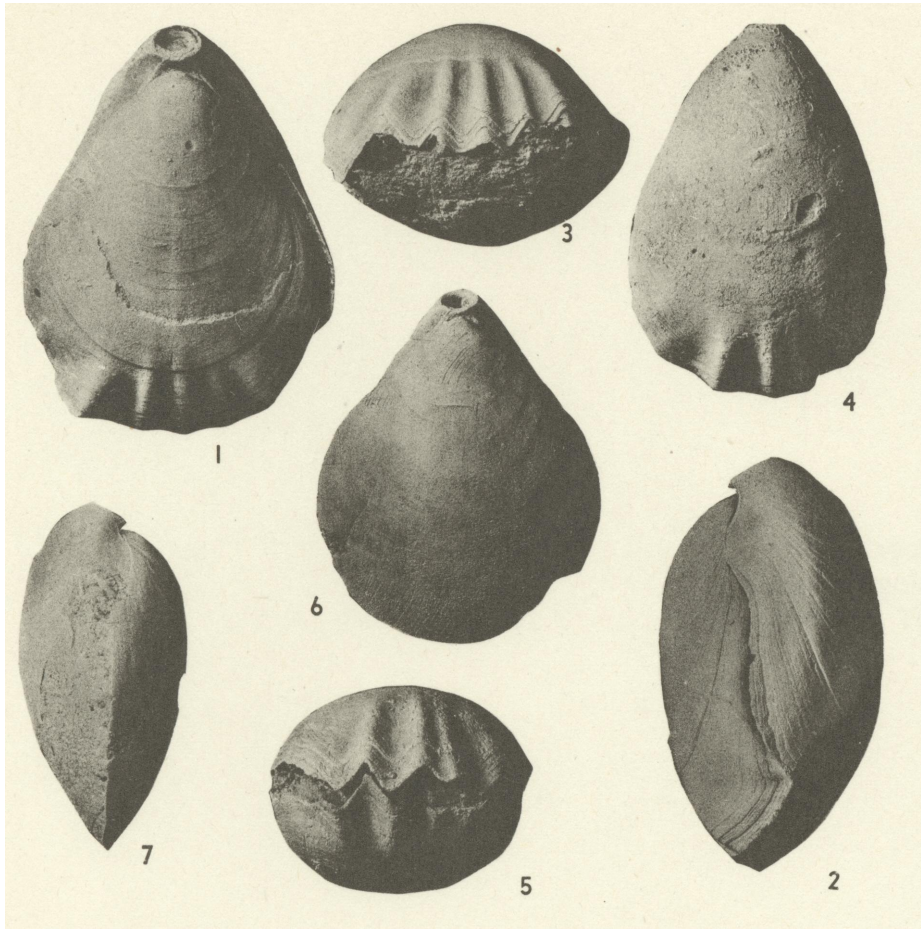
Shell small, rounded trigonal, smooth behind, plicate anteriorly; ventral valve with a prominent, acute, hardly recurved beak, with a small peduncular foramen, the deltidial plates, etc., as above described; hinge-line somewhat flexuous, anterior margin of the valve with a broad double fold produced haemally, with two or three less pronounced plications laterally; haemal valve convex, reciprocally plicate; interior filled with a hard matrix; shell structure fibrous. Length 11.0, breadth 9.5, dorsoventral maximum diameter 6.0 mm.

This pretty little species appears to be rare, as only two specimens were obtained.

Dimensions: Figured type, longitude 8.2 mm.

Observations: *Rhynchonella salpinx* Dall and *Rh. holmesii* Dall have the same type locality. The former species has fewer and coarser plications than the latter.

CANIPES RAVENEL



Figs. 1–3—dorsal, lateral, and anterior views of neotype 1, without outer accessory folds,

Figs. 4, 5—ventral and anterior views of neotype 2, with the outer accessory folds and one of the inner folds missing,

Figs. 6, 7—ventral and lateral views of neotype 3, without folds; all X 2.

Type Data: Type of Ravenel presumably lost. Neotypes in Bureau of Economic Geology, Austin, Texas.

Type Locality: Marl pits on bottom of a small intermittent creek on plantation of Dr. I. G. Prioleau, about 5 miles south of Black Oak I ock of Santee Canal, St. Johns Parish, Berkeley County, South Carolina. Neotypes from marl pits one mile east of Rocky Point, Pender County, North Carolina.

Synonymy:

1844 *Terebratula canipes* Ravenel, E., Description of some new species of fossil organic remains, from the Eocene of South Carolina: Acad. Nat. Sci. Philadelphia Proc., vol. 2, no. 5, p. 97.

1845 *T. wilmingtonensis* Lyell, C., & Sowerby, G. B., *in* Lyell, C., Observations on the White Limestone and other Eocene or Older Tertiary formations of Virginia, South Carolina, and Georgia: Geol. Soc. London Quart. Jour., vol. 1, p. 431–432, text fig. b.

1875 *T. demissirostra* Conrad, T. A., *in* Kerr, W. C., Report on the Geological Survey of North Carolina, Raleigh, p. 18, pl. 3, fig. 1.

1903 *T. wilmingtonensis*, Dall, W. H., Contributions to the Tertiary fauna of Florida with especial reference to the Silex beds of Tampa and the Pliocene beds of the Caloosahatchie River, etc.: Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1537, pl. 58, figs. 14–20.

1926 Kellum, L. B., Paleontology and stratigraphy of the Castle Hayne and Trent marls in North Carolina: U. S. Geol. Survey Prof. Paper 143, p. 33–34.

Original Description: Larger valve, pear-shaped, convex; beak rather large and prominent; seven plaits extending from the anterior, and part of the lateral margin to about two-thirds of the shell towards the beak, three of these occupying the middle, and two others, less prominent, each of the sides; margin deeply toothed by the plaits. Length 1¾ inches, width 1⅝ inches.

Revised Description: Shell smooth, biconvex in the young stage and up to 3 cm. in length; variable in shape from cuneate in outline and thick or nearly cylindrical (Dall 1903, fig. 19) to elongate-pentagonal in outline and lenticular in cross section. Curvature of valves regular and equal in the plane of symmetry. In the broader specimens the curvature decreases progressively from the umbo to the anterior. In the narrower specimens the curvature decreases from the umbo to the middle of the valve and increases again toward the anterior margin. This increase is accompanied by the formation of the folds. Folds of the anterior margin are alternate and arise usually rather late in the growth of the shell. When fully developed the folds are sharp. The folds are variably developed in different specimens. In the most complete cases there are 3 equal medium-sized folds in the middle flanked by a larger fold on each side, which descends into a large and broad sulcus; in addition there are up to 2 small, accessory folds to each side of this sulcus. The maximal observed number of folds in the brachial valve is 9. Of these 9 folds the 4 outer, accessory folds are absent in most specimens. The 3 inner folds are variable; in some specimens there are only 2 of them and these unequal in size. The folding presumably develops from sulciplication by imposition of the 3 inner folds on the central sulcus of the sulciplicate stage and addition of the outer, accessory folds. Beak suberect. Foramen large, circular, mesothyrid, labiate. Beak ridges broadly rounded.

Geologic Horizon: Santee limestone, Jackson group, upper Eocene.

Distribution: Reported distribution in the Santee limestone of South Carolina and Castle Hayne marl of North Carolina, all Jackson group, upper Eocene. The types of *wilmingtonensis* and *demissirostra* came from the vicinity of Wilmington, New Hanover County, North Carolina.

Observations: Terebratula canipes Ravenel is smaller than *T. harlani* Morton which also lacks the tendency to numerous and strong anterior plications. *Terebratula posteriora* Kellum is closely related to *T. canipes*. Its principal points of difference are the heavy, prominent hinge teeth and the pronounced posterior thickening of the shell.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

GLOSSA CONRAD

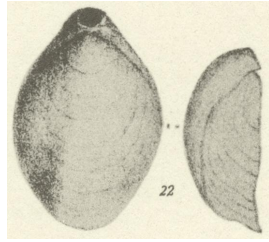


Fig. 22—Conrad 1870.

Type Data: Unknown.

Type Locality: Shark River, Monmouth County, New Jersey (Whitfield 1885).

Geologic Horizon: "Green marl of the Upper Bed" Cook 1868 = Manasquan marl, middle Eocene.

Distribution: Manasquan marl, middle Eocene of New Jersey.

TEREBRATULA

Synonymy:

1868 *Terebratula glossa* Conrad, T. A., *in* Cook, G. H., Geology of New Jersey, Newark, p. 377, 732, text fig. on p. 377.

1870 Conrad, T. A., Descriptions of Miocene, Eocene, and Cretaceous shells: Am. Jour. Conchology, vol. 5, p. 42–43, pl. 1, fig. 22.

1885 *Terebratulina atlantica* [in part], Whitfield, R. P., Brachiopoda and Lamellibranchiata of the Raritan clays and greensand marls of New Jersey: U. S. Geol. Survey Mon. 9, p. 9–11, pl. 1, figs. 11, 12 (only). Not *Terebratulina atlantica* (Morton).

1940 *Terebratula glossa*, Stenzel, H. B., New Eocene brachiopods from the Gulf and Atlantic Coastal Plain: Univ. Texas Pub. 3945, p. 727.

Original Description: Oblong, sub-ovate, ventricose; biplicated; ventral valve flattened medially and with a nearly straight outline throughout; lateral margins towards the base obliquely truncated; basal margin obtusely rounded.

Locality.—N. Jersey.

Observations: This shell is nearly allied to *T. biplicata*, but differs in the nearly straight line of the ventral valve, and in the oblique area of the foraminal portion of the beak. It is an Eocene species; the former Cretaceous. (Conrad 1870).

Observations (Stenzel 1940): Although Whitfield and Weller (Weller, S., A report on the Cretaceous paleontology of New Jersey: New Jersey Geol. Survey, Pal. ser., vol. 4, p. 360, 1907) considered *Terebratula glossa* Conrad as a synonym of *Terebratulina atlantica* (Morton), it is clear that *Terebratula glossa* Conrad cannot be a *Terebratulina*. Conrad did not mention any fine ribs as occurring on *Terebratula glossa* and compared this species with *Terebratula biplicata* from the Cretaceous of western Europe. Conrad's descriptions and comparisons make it highly improbable that he would mistake a *Terebratulina* for a *Terebratula*.

Remarks: The species should be restudied. The generic assignment is possibly incorrect.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

HARLANI MORTON

TEREBRATULA

Type Data: Types in Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania.

Type Locality: Bluff 28 feet high on bank of Crosswicks Creek, about one-half mile from New Egypt, Burlington County, New Jersey.

Geologic Horizon: Upper part of Hornerstown formation, Rancocas group, lower Eocene.

Distribution: Most abundant at the top of the Hornerstown formation. Widely distributed in the Hornerstown and Vincentown formations, the two formations of the Rancocas group, in New Jersey. Also in the lower Eocene Aquia formation on Western Branch, 3 miles west of Leeland, Prince Georges County (Piscataway member), and on Severn River opposite Annapolis, Anne Arundel County (Paspotansa member), in Maryland (Clark & Martin 1901).

Original Description of subfragilis (= fragilis): *Shell* very thin, twice as long as broad, sides straight and nearly parallel, concentrically striated; *upper valve* flattened, subconvex, with two very elevated ridges almost the whole length of the shell, and having a deep sinus between them; lateral sinuses less marked: *inferior valve* very convex, with a prominent central ridge and corresponding lateral depressions; *beak* incurved, *foramen* small.

Length an inch and a half; *breadth* three-fourths of an inch.

Original Description of camella (= perovalis): *Shell* ovate, concentrically and longitudinally striated: *upper valve* biplicated, sulcated at the front and sides; *lower valve* thick, *umbo* prominent, *beak* incurved.

Length an inch and three quarters: *breadth* an inch and a half.

Observations: The varieties and species distinguished by Morton are presumably merely growth forms. The name *fragilis* Morton is preoccupied by *Terebratula fragilis* Schlotheim, E. F., Tasch. Min., 1813, p. 104 (name and figure only) and by *T. frag.* König, C. D. E., Icones foss. sect. fo., p. 3, London 1825. *Subfragilis* is a substitute for *fragilis* Morton non Schlotheim. The name *camella* Morton is a substitute for *perovalis?* Morton non J. de C. Sowerby, Mineral Conchology, vol. 5, p. 51, London 1823.

Terebratula harlani is larger than *T. canipes* Ravenel and *T. posteriora* Kellum. It also lacks the tendency to numerous and strong anterior plications which is characteristic of *T. canipes.*

Synonymy:

1828 *Terebratula harlani* + *fragilis* + *perovalis?* Morton, S. G., Description of the fossil shells which characterize the Atlantic Secondary Formation of New Jersey and Delaware; including four new species: Acad. Nat. Sci. Philadelphia Jour., 1st ser., vol. 6, pt. 1, p. 73–76, 77–79, 93–96, pl. 3, figs. 1–4, 7–8.

1830 *T. harlani* + *fragilis* Morton, S. G., Synopsis of the organic remains of the ferruginous sand formation of the United States; with geological remarks: Am. Jour. Sci., 1st ser., vol. 17, no. 2, art. 3, p. 283, and vol. 18, no. 2, art. 4, pl. 3, figs. 16, 17.

1833 *T. harlani* Morton, S. G., Supplement to the "Synopsis of the organic remains of the ferruginous sand formation of the United States": Am. Jour. Sci., 1st ser., vol. 24, no. 1, art. 11, p. 130, pl. 9, figs. 8, 9.

1834 *T. harlani* + *camella* + *fragilis* Morton, S. G., Synopsis of the organic remains of the Cretaceous group of the United States, Philadelphia, p. 70–71, pl. 3, figs. 1, 2, pl. 9, figs. 8, 9.

1850 *T. subfragilis* D'Orbigny, A., Prodrome de paléontologie stratigraphique universelle des animaux mollusques & rayonnés faisant suite au cours élémentaire de paléontologie et de géologie stratigraphiques, Paris, vol. 2, p. 258.

1885 *T. harlani* + *fragilis* + *perovalis*, Whitfield, R. P., Brachiopoda and Lamellibranchiata of the Raritan clays and greensand marls of New Jersey: U. S. Geol. Survey Mon. 9, p. 6–9, pl. 1, figs. 15–23.

1901 *T. harlani*, Clark, W. B., & Martin, G. C., Molluscoidea Brachiopoda, *in* Systematic Paleontology, Eocene: Maryland Geol. Survey, Eocene, p. 204, pl. 58, figs. 2, 3, 3a.

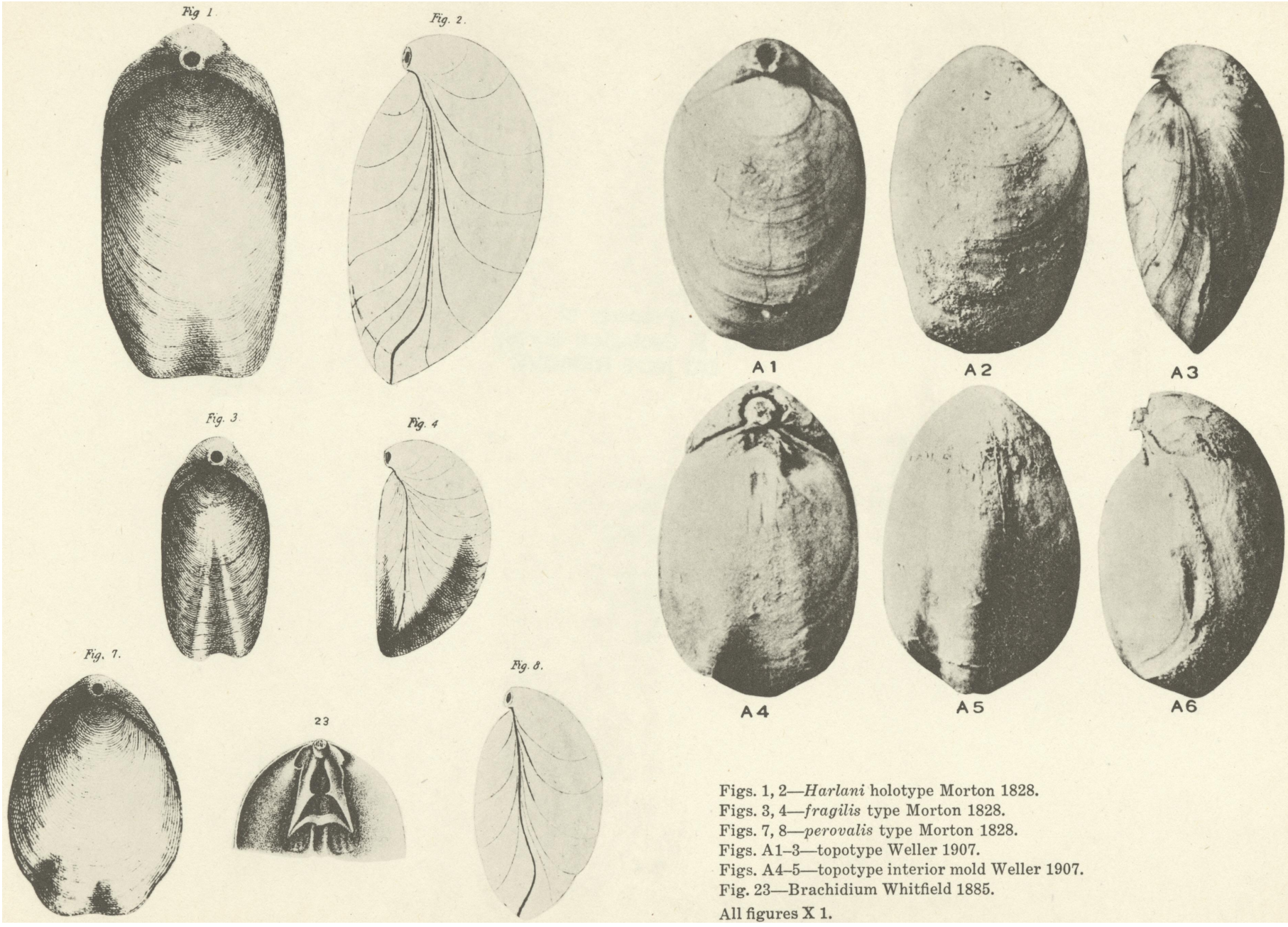
1907 *T. harlani* + var. *fragilis*, Weller, S., A. report on the Cretaceous paleontology of New Jersey: New Jersey Geol. Survey, Paleont. ser., vol. 4, p. 375–380, pl. 28, figs. 1–8.

1922 *T. marylandica* Roberts, J. K., New Terebratula from Eocene terrane of Maryland: Pan-Am. Geologist, vol. 38, no. 1, p. 19–28, pl. 3.

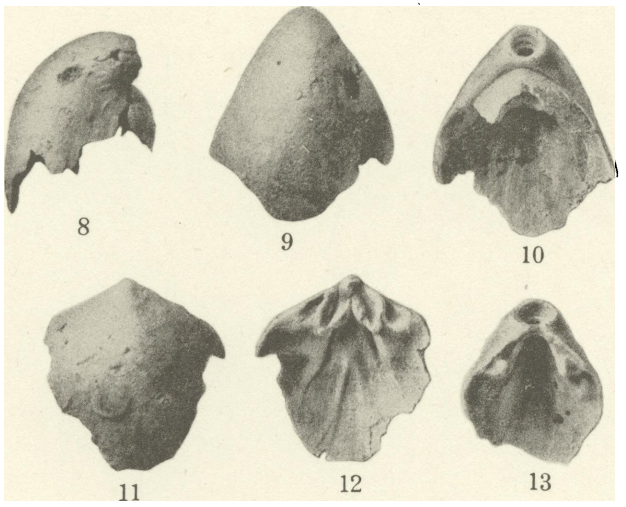
Original Description: *Shell* large, about twice as long as broad, sides straight and imperfectly parallel: *upper valve* plano-convex, obscurely biplicated except near the margin, which has three inconsiderable sinuses: *lower valve* very convex, with a longitudinal ridge and slight lateral depressions; *beak* incurved; *umbo* prominent.

Length two and a half inches: *breadth* an inch and a half.

Variety A. Sides straight, but approximate more or less towards the anterior margin, giving the shell somewhat the shape of a coffin.—Other specimens are more rounded at the sides, and others again straighter, than the one figured. In one or two specimens the upper valve is extremely convex, but the general appearance of the shell nevertheless conforms to the above description.



Figs. 1, 2—*Harlani* holotype Morton 1828.
Figs. 3, 4—*fragilis* type Morton 1828.
Figs. 7, 8—*perovalis* type Morton 1828.
Figs. A1–3—topotype Weller 1907.
Figs. A4–5—topotype interior mold Weller 1907.
Fig. 23—Brachidium Whitfield 1885.
All figures X 1.



Figs. 8–13—Kellum 1926.

Type Data: Types in U. S. Nat. Mus., Washington, D.C.

Type Locality: Marl pits on farm of B. F. Smith, 5 miles west of Pink Hill, Duplin County, North Carolina.

Geologic Horizon: Castle Hayne marl, Jackson group, upper Eocene.

Distribution: Known only from type locality.

Synonymy:

1926 *Terebratula crassa* Kellum, L. B., Paleontology and stratigraphy of the Castle Hayne and Trent marls in North Carolina: U. S. Geol. Survey Prof. Paper 143, p. 34, pl. 7, figs. 8–13.

1931 *T. posteriora* Kellum, L. B., Revision of the names of three fossils from the Castle Hayne and Trent marls in North Carolina: Washington Acad. Sci. Jour., vol. 21, no. 4, p. 51–52.

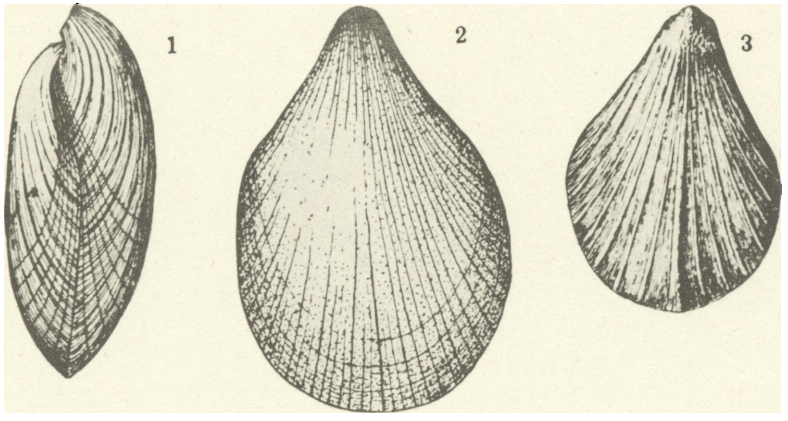
Original Description: Test of medium size, ovate, rostrate, smooth; ventral valve strongly inflated and very thick posteriorly, causing the interior of the shell in that region to be very constricted; hinge teeth prominent and thick; beak full, short, curving downward and abruptly truncated at the apex by a large foramen which is strongly excavated at the opening through the thickness of the shell; cardinal area small, triangular, truncated by the foramen, slightly concave, and covered by numerous rectangular plates. The dorsal valve is much less inflated than the ventral. It is thick posteriorly and thins toward the anterior; cardinal process prominent; dental sockets deep; hinge plates prominent; muscular impressions distinct. Dimensions of figured fragments: Ventral valve, length, 25 millimeters; width, 24 millimeters; dorsal valve, length, 26 millimeters; width, 24 millimeters.

Terebratula crassa is closely related to *T. wilmingtonensis.* Its principal points of difference are the heavy, prominent hinge teeth and the pronounced posterior thickening of the shell. The anterior portion of this species must be extremely fragile, as it is missing in every one of the 25 specimens which the writer has at hand.

Observations: Terebratula posteriora differs from *T. harlani* by the more elongate region of the beak in the former species.

BRUNDIDGENSIS ALDRICH

TEREBRATULINA



Figs. 1–3—Aldrich 1907.

Type Data: Types presumably in Geological Department, The Johns Hopkins Univ., Baltimore, Maryland.

Type Locality: Waterwell tank near railroad station at Brundidge, Pike County, Alabama.

Geologic Horizon: Unnamed limestone below the Nanafalia formation, Wilcox group, lower Eocene.

Distribution: Known only from type locality.

Synonymy:

1907 *Terebratulina brundidgensis* Aldrich, T. H., Some new Eocene fossils from Alabama: The Nautilus, vol. 21, no. 1, p. 8, 9, pl. 1, figs. 1, 2, 3.

Original Description: Shell medium, narrower than high, radial threads very strong in the young shell becoming finer in the older, and in the oldest forms appearing as very fine lines only. A central, raised rib doubled shows on the ventral valve, replaced with a depression between two ribs on dorsal valve; foramen oblong. Longest diameter 14 mm., width 11 mm. Smallest form figured is 9½ mm. and 7 mm.

Locality: Eocene of Brundidge, Ala.

Remarks: This species occurs in a stratum of white limestone which was exposed in a large well close to the R. R. station. This well was dug for water for a supply for the engines, but when the limestone stratum was dug into it failed as a water tank. Associated with the species is *Terebratula wilmingtonensis* L. & S., *Ostrea vomer* Morton and several other species which occur in the white limestone or Jackson horizons. The area surrounding the well is typical Nanafalia lignitic deposits. So far no other outcrop of this limestone has been observed in the vicinity, but careful search is yet to be made. This discovery was called to my attention by Dr. E. A. Smith, State Geologist of Alabama, who sent me a number of specimens. We subsequently visited the well together and went over the locality south of the town, failing to find an outcrop. Dr. Smith thinks his discovery is an "overlap" of the white limestone or Vicksburg, somewhat as in certain Georgia localities. All the different forms of *Terebratula wilmingtonensis* mentioned and figured by Prof. Dall in Vol. 3 of Wagner Free Inst. of Science, p. 1537, pl. 58, figures 14–20, are found here.

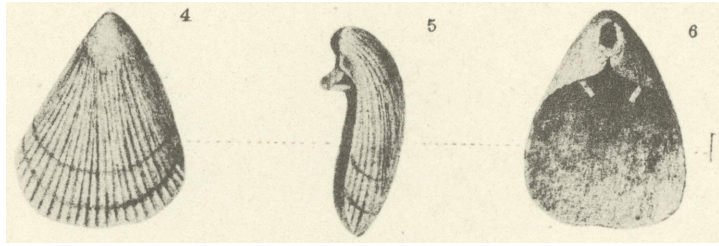
Observations: Aldrich's conclusions concerning the Jackson age of this fossil and his identification of *Terebratula wilmingtonensis* L. & S. seem to be erroneous. The geologic map of Alabama (1926) shows only Nanafalia formation at Brundidge and the Jackson is too far away to produce outliers at that place.

According to a communication from L. D. Toulmin, the limestone is the facies equivalent of the Salt Mountain limestone, Wilcox group, lower Eocene, and is exposed in central Alabama and east Alabama. This limestone has heretofore been considered uppermost Midway but may be found to be more closely related to the Wilcox. The lower contact has not been seen, but at Ft. Gaines the limestone is unconformably overlain by the Nanafalia formation. It contains some brachiopods also found in the Salt Mountain limestone.

This species seems to be characterized by its central doubled rib which distinguishes it from *T. innovata* De Gregorio, *T. lachryma* (Morton), *T. louisianae* Stenzel, *T. manasquani* Stenzel, and *T.* sp. Toulmin.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

INNOVATA DE GREGORIO



Figs. 4, 5, 6—De Gregorio 1890.

Type Data: Monotype in De Gregorio home, Via Molo 132, Palermo, Italy.

Type Locality: Presumably Claiborne, Monroe County, Alabama.

Geologic Horizon: Presumably from the Scutella bed, upper Claiborne group, middle Eocene, or Ocala limestone, basal Jackson group, upper Eocene.

Distribution: No other specimen known.

Synonymy:

1890 *Terebratulina innovata* de Gregorio, A., Monographie de la faune Éocénique de l'Alabama et surtout de celle de Claiborne de l'étage Parisien: Annales de Géologie et de Paléontologie, livr. 7 and 8, p. 238, pl. 39, figs. 4–6.

Original Description (translated): Shell tiny, elegant, narrow, little inflated, subpear-shaped, with narrow radial striae; foramen round and marked; deltidium narrow.

This is a species which much resembles *T. caput-serpentis* L. living in our seas.

Locality: I am not certain of its provenance, because Conrad does not cite any species of this genus and the matrix of my specimen is a whitish soft lime, which differs much from the Claiborne rock.

This species differs from *T. lachryma* Morton by its deltidium and the shape of its foramen.

Observations: Whitish soft limestone beds crop out above the Gosport (Claiborne) sand at Claiborne bluff. The specimen may have come from these beds.

This species is one of the two smallest of the six species of this genus. *Terebratulina manasquani* Stenzel is 6 times, *T. louisianae* Stenzel is 5 times, *T. brundidgensis* Aldrich is 4 times, and *T. lachryma* (Morton) is 3 times as large; *T.* sp. Toulmin is about the same size. *Terebratulina manasquani* is subpentagonal in outline and has a median sinus and fold, *T. louisianae* is broadly oval in outline, *T. brundidgensis* is elongate oval in outline and has a central doubled rib, *T. lachryma* is slender oval in outline, *T.* sp. Toulmin is subpentagonal in outline and has nodulated ribs; *T. innovata* differs in being subtriangular in outline and having a wide and straight anterior margin.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

LACHRYMA (MORTON)

TEREBRATULINA

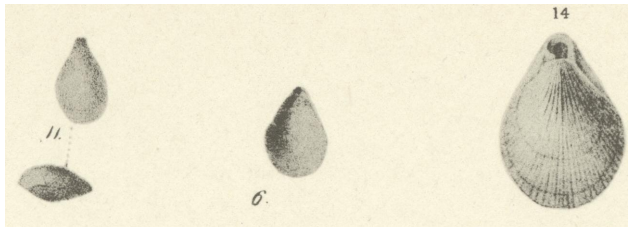


Fig. 11—Morton 1833 and Morton 1834,
Fig. 6—Morton 1834,
Fig. 14—Whitfield 1885.

Type Data: Presumably in Acad. Nat. Sci. Philadelphia, Philadelphia, Pennsylvania.

Type Locality: South Carolina. Presumably from the marl pits on Fair Spring Plantation (Robert W. Mazyck, owner about 1840) near Macbeth and the old Santee Canal, Berkeley County, South Carolina.

Geologic Horizon: Santee limestone, Jackson group, upper Eocene.

Observations: Morton's figures are inadequate indicating little more than the general shape. The best and only other illustration is Whitfield's. This illustration depicts a specimen from the same stratigraphic horizon and the same general region as Morton's types. The dimensions given by Morton are obviously inaccurate because they do not agree with his figures. The dimensions given by Kellum are accurate, but refer to material from another region.

Morton's types were collected by T. A. Conrad in 1833. Conrad's route of travel brought him to the vicinity of the Santee Canal, where he spent almost the whole of February, 1833. (Compare Wheeler, H. E., Timothy Abbott Conrad, with particular reference to his work in Alabama one hundred years ago: Bull. Am. Paleontology, vol. 23, no. 77, p. 1–158, pls. 1–27, 1935). It is probable that the types were collected there. The best locality in that vicinity were the marl pits.

Terebratulina lachryma (Morton) is more slender ovate in outline than and half as large as *T. louisianae* Stenzel. It is one-half the size of *T. manasquani* Stenzel and has no median fold, which is present in the latter species. *Terebratulina brandidgensis* Aldrich has a central raised doubled rib on the ventral valve, but its shape is similar to *T. lachryma; T. innovata* De Gregorio is a tiny species of subtriangular outline; *T.* sp. Toulmin is also tiny and has nodulated ribs.

Synonymy:

1833 *Terebratula lachryma* Morton, S. G., Supplement to the "Synopsis of the organic remains of the ferruginous sand formation of the United States": Am. Jour. Sci., 1st ser., vol. 24, art. 11, p. 130, pl. 10, fig. 11.

1834 Morton, S. G., Synopsis of the organic remains of the Cretaceous group of the United States, Philadelphia, p. 72, pl. 10, fig. 11, and pl. 16, fig. 6.

1842 Lyell, C., On the Tertiary formations and their connexion with the chalk in Virginia and other parts of the United States: Geol. Soc. London Quart. Jour., Proc., vol. 3, p. 737.

1850 *Terebratulina lacryma*, d'Orbigny, A., Prodrome de paléontologie stratigraphique universelle des animaux mollusques & rayonnés, Paris, vol. 2, p. 396.

1885 *Terebratulina lachryma*, Whitfield, R. P., Brachiopoda and Lamellibranchiata of the Raritan clays and greensand marls of New Jersey: U. S. Geol. Survey Mon. 9, p. 12, pl. 1, fig. 14.

1903 Dall, W. H., Contributions to the Tertiary fauna of Florida with especial reference to the Silex beds of Tampa and the Pliocene beds of the Caloosahatchie River, etc.: Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1536.

1926 Kellum, L. W., Paleontology and stratigraphy of the Castle Hayne and Trent marls in North Carolina: U. S. Geol. Survey Prof. Paper 143, p. 34.

Original Description: Ovato-triangular; beak produced, foramen large; both valves marked by delicate longitudinal striae. Length half an inch.

From the calcareous strata of South Carolina.

Description by Morton 1834: Specific character. Ovato-triangular; beak elongated, foramen large; valves convex, marked by delicate longitudinal striae.

Length, half an inch; breadth, one-fourth of an inch.

This beautiful species is abundant in the calcareous strata of South Carolina, whence I received it through Mr. Conrad. This gentleman has more recently obtained it from the same strata below Claiborne, Alabama.

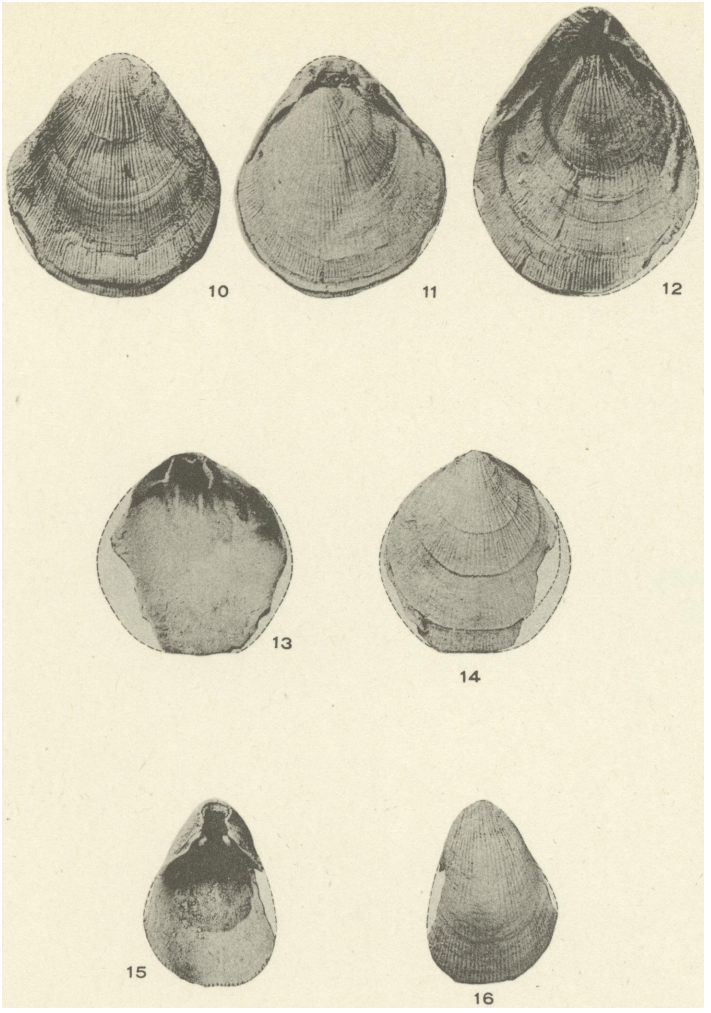
Description by Kellum 1926: Morton's brief description may be supplemented by characterizing *T. lachryma* as a very small, delicate shell with depressed form and lens-shaped cross section perpendicular to the plane between the valves. The marginal outline of small specimens is distinctly oval, with an acute angle at the beak; large and more inflated individuals are subcircular, with an obtuse angle at the beak. The ventral beak, with large foramen, curves downward over an extremely small false cardinal area. Surface of both valves sculptured with concentric growth lines and fine radial striae, faintly cancellated. Length, 11 millimeters; width, 8.5 millimeters; thickness, 5.5 millimeters.

Distribution: Reported distribution in the Santee limestone of South Carolina, Castle Hayne marl of North Carolina, and Ocala limestone of Alabama and Florida, all in Jackson group, upper Eocene.

In Alabama it occurs in the "Zeuglodon bed" which lies above the Cocoa sand (compare Cooke, C. W., The age of the Ocala limestone: U. S. Geol. Survey Prof. Paper 95, p. 109, 116, 117, 1915, and Cooke, C. W., Definition of Cocoa sand member of Jackson formation: Am. Assoc. Petroleum Geologists Bull., vol. 17, p. 1387–1388, 1933).

LOUISIANAE STENZEL

TEREBRATULINA



Figs. 10, 11—ventral and dorsal views of shell, syntype 1,
Fig. 12—dorsal view of shell, syntype 2,
Figs. 13, 14—inside and outside views of brachial valve, syntype 3,
Figs. 15, 16—inside and outside views of pedicle valve, syntype 4; all X 2.

Geologic Horizon: Glauconite marls in lower part of Cane River formation, Claiborne group, middle Eocene. The brachiopods occur about 10 to 20 feet above the base of the Cane River formation.

Distribution: Known only from type locality.

Synonymy:

1940 *Terebratulina louisianae* Stenzel, H. B., New Eocene brachiopods from the Gulf and Atlantic Coastal Plain: Univ. Texas Pub. 3945, p. 722–724, pl. 34, figs. 10–16.

Original Description: Shell large for the genus. Both valves about equally convex, thin, and punctate. Pedicle valve elongate oval and with a straight beak which is slightly obliquely truncated by the foramen. Foramen large, semicircular. Deltidial plates missing. The hinge teeth are strong, high, and compressed. Brachial valve is subcircular in outline, but the anterior margin has a short stretch in the middle which is straight. There are small *Pecten*-like ears at the hinge. These ears are developed in youth but disappear in maturity. Both valves ornamented with numerous fine, dichotomous or intercalating ribs. The ribs are roundly arched in cross section, the interspaces being narrower than the ribs. The ribs are slightly wider along the midline than to both sides of each valve. The ribs are crossed by numerous fine growth lines which produce very fine wrinkles upon the ribs. Average width of a rib is 1/6 to 1/7 mm.

Dimensions.—The largest type specimen is 21.6 mm. long. Other types are

19.2 mm. long, 14.4 mm. wide	(See Pl. 34, fig. 12.)
15.6 mm. long, 14.7 mm. wide	(See Pl. 34, figs. 10–11.)
14.5 mm. long, 13.2 mm. wide	
15.2 mm. long, 13.0 mm. wide	
16.4 mm. long, 12.7 mm. wide	
18.9 mm. long, 17.1 mm. wide	

All specimens measured are pressure-flattened. This flattening has increased the width but has left the length almost unchanged.

Original Remarks: There are six species of this genus known from the Tertiary beds of the Gulf and Atlantic Coastal Plain of North America. The other five known species are *T. brundidgensis* Aldrich from the Nanafalia formation of the Wilcox group, lower Eocene, of Alabama; *T. innovata* De Gregorio from the "*Scutella*" bed, Claiborne group, middle Eocene, or the Ocala limestone, Jackson group, upper Eocene, of Alabama; *T. lachryma* (Morton) from the Santee limestone of the Jackson group, upper Eocene, of South Carolina; *T. manasquani* Stenzel from the Manasquan formation, middle Eocene, of New Jersey; and *Terebratulina* n.sp. Toulmin from the Salt Mountain limestone of the Wilcox group, lower Eocene, of Alabama. Comparison of the new species with these five is difficult on account of the crushed nature of the new species.

Terebratulina louisianae Stenzel is about twice as large as *T. lachryma* (Morton) and *T. brundidgensis* Aldrich and about the same size as *T. manasquani* Stenzel. *Terebratulina lachryma* (Morton) and *T. brundidgensis* Aldrich are also in outline more elongate-oval than *T. louisianae*. *Terebratulina manasquani* Stenzel has a median sinus and fold at the anterior margin of the valves. This feature is absent in the other species. *Terebratulina* n.sp. Toulmin is a tiny species about one-sixth the size of *T. louisianae* and is characterized by nodulated ribs. *Terebratulina innovata* De Gregorio is a tiny species of subtriangular outline.

Type Data: Numerous syntypes in Stenzel collection, Austin, Texas.

Type Locality: Cut on west side of gravelled State highway No. 12, Chestnut-Creston road, 1.47 miles south of railroad depot at Chestnut, near center of sec. 7, R. 6 W., T. 12 N., Natchitoches Parish, Louisiana. This part of the highway is the road bed of an abandoned railroad. This is Bureau of Economic Geology locality No. La-6.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

MANASQUANI STENZEL

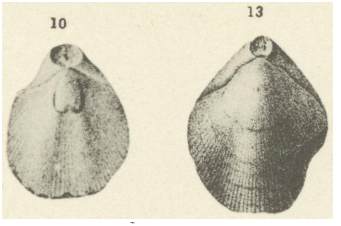


Fig. 10—lectoparatype,
Fig. 13—lectoholotype; Whitfield 1885.

Type Data: The holotype was, according to Whitfield, in the collection of Miss F. M. Hitchcock, of New York. It is not known where the type is now.

Type Locality: Marl pits along Manasquan River, 1 mile south of Farmingdale, Monmouth County, New Jersey.

Geologic Horizon: Manasquan marl, middle Eocene.

Distribution: Manasquan marl, middle Eocene, of New Jersey.

Synonymy:

1885 *Terebratulina atlantica* (in part), Whitfield, R. P., Brachiopoda and Lamellibranchiata of the Raritan clays and greensand marls of New Jersey: U. S. Geol. Survey, Mon. 9, p. 9–11, pl. 1, figs. 10, 13, not figs. 11, 12. [*Not Terebratulina atlantica* (Morton) 1842.]

1907 *Terebratulina atlantica* (in part), Weller, S., A report on the Cretaceous paleontology of New Jersey: New Jersey Geol. Survey, Paleont. ser., vol. 4, p. 360–361, pl. 28, figs. 9–12.

1940 *Terebratulina manasquani* Stenzel, H. B., New Eocene brachiopods from the Gulf and Atlantic Coastal Plain: Univ. Texas Pub. 3945, p. 725–728.

Original Description: Shell outline subpentagonal and comparatively broad. The anterior margin of the shell is truncated. Pedicle valve with a short and broad beak, the angle of convergence of the sides being about 80 degrees. Brachial valve with short *Pecten*-like ears. Both valves ornamented with radial striae. The anterior margin of the shell has a gentle fold.

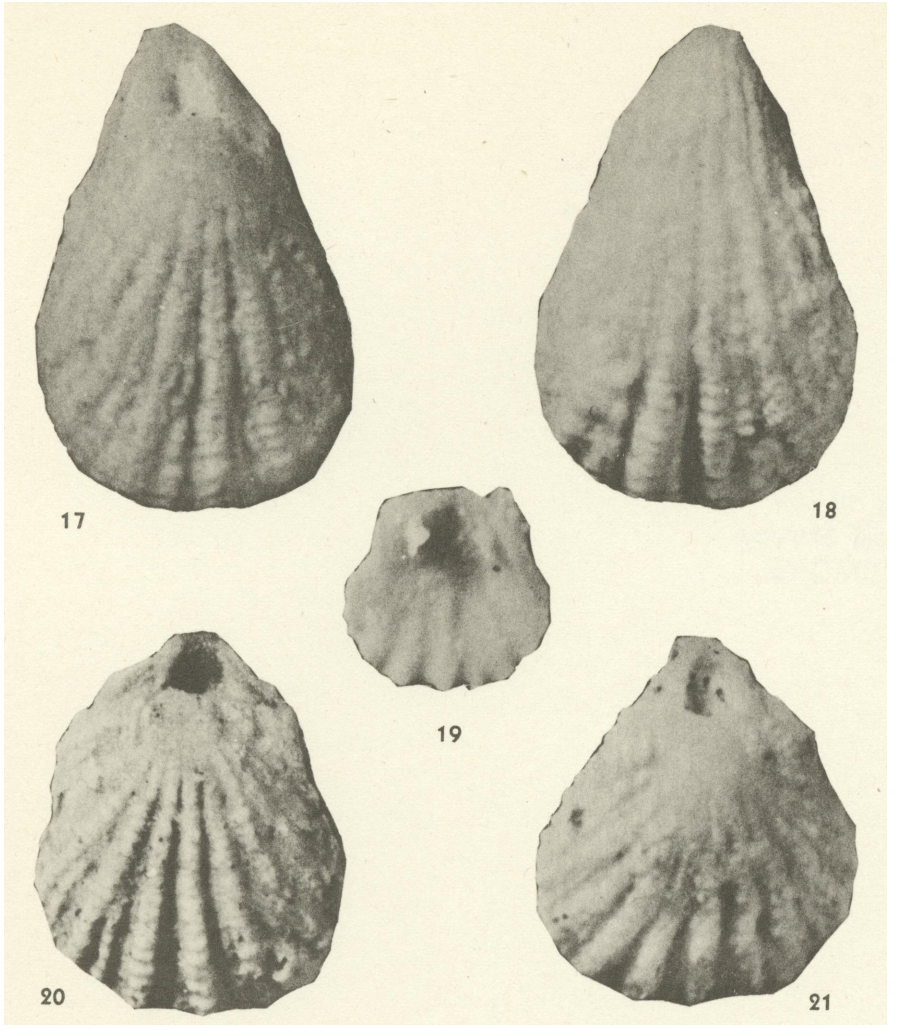
Dimensions.—Length 23.0 mm., width 17.5 mm.

Remarks: Stenzel 1940 gives an extensive discussion of brachiopods confused with this species by some authors.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

SP. TOULMIN

TEREBRATULINA



Figs. 17, 18—dorsal and ventral view of specimen No. 50750,
Fig. 19—interior of dorsal valve, No. 50751,
Fig. 20—dorsal view of specimen, No. 50752,
Fig. 21—dorsal view of specimen; all X 20.

Type Data: Figured specimens, Nos. 50750–50752, in Geology Dept., Princeton, University, Princeton, New Jersey. Specimen (fig. 21) in Alabama Mus. Nat. History, University, Alabama.

Synonymy:

1940 *Terebratulina* sp. Toulmin, L. D., Eocene brachiopods from the Salt Mountain limestone of Alabama: Jour. Paleontology, vol. 14, p. 230–231, pl. 28, figs. 17–21.

Original Description: Shell small, biconvex, subtrigonal in outline. Cardinal margin submegathyrid. Test with nodulous costae equally developed on both valves. Interior of the valves crenulated along the margin. Beak short. Foramen large, triangular.

Dimensions of illustrated specimen, figs. 17, 18: Length, 3.18 mm; width, 2.22 mm.

Original Remarks: No complete full-grown specimens of this genus were obtained. Several complete specimens possessing features characteristic of the youthful stage of *Terebratulina* and fragments of the shells of mature individuals were found. These fragments and the more mature complete specimens indicate that the genus is *Terebratulina* and not *Eucalathis*. The young shell resembles the latter genus in such features as the triangular cardinal area, straight hinge line, and the subtrigonal outline of the shell. The fragments of mature individuals show a change in the shape of the shell, a shortening of the hinge line, an increase in number of ribs, and a great decrease in their relative size. The Salt Mountain form bears a closer resemblance to the figures of young specimens of *Terebratulina retusa* Linné, the type species of the genus, than to figures of *Eucalathis murrayi* Davidson. The foramen is triangular and not rounded as in *Eucalathis* and the ribs are narrower. Davidson (1886–1888) makes the following statement concerning the young form of *T. retusa:*

The shell varies somewhat in shape and especially, according to age, in the number of its ribs. These modifications have been often described by myself and others, and most recently, in 1884, by M. E. Deslongchamps (*Études, critiques sur des brachiopodes nouveaux ou peu connu:* Caen, 1884). In the youngest condition the shell tapers posteriorly, and is widest anteriorly; the hinge line is then almost straight, the auricular expansions comparatively larger, the foramen triangular or elongated oval . . . As the shell grows larger, the auricular expansions become smaller, the hinge line oblique, or obtusely angular, the ribs more numerous and finer, the lines of growth less prominent, and the greatest breadth at about half the shell's length. Similar important modifications take place also in the interior of the valves.

Type Locality: 26 to 48 feet below top of Salt Mountain, about 6 miles south of Jackson, Clarke County, Alabama, southwest ¼ of southwest ¼ of sec. 34, T. 6 N., R. 2 E. (figs. 17–19, 21). Top of high hill 3000 feet south of Salt Mountain (fig. 20).

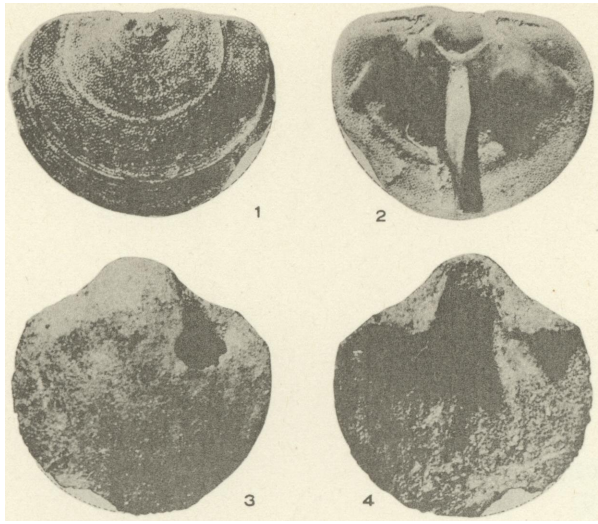
Geologic Horizon: Salt Mountain limestone, Wilcox group, lower Eocene.

Distribution: Known only from type locality.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

AKYMATOPHORA STENZEL

ARGYROTHECA



Figs. 1, 2—outside and inside of brachial valve, syntype 1,
Figs. 3, 4—outside and inside of pedicle valve, syntype 4; all X 7.

Type Data: Four syntypes in Stenzel collection, Austin, Texas.

Type Locality: Stone City (or Moseleys Ferry) on Brazos River, that is, the bluff on the right or south bank of the river at the bridge of the new State highway No. 21 and the bridge of the Houston & Texas Central (Southern Pacific) Railroad, 11.3 miles west of Bryan, Brazos County, as measured by speedometer along highway No. 21, Burleson County, Texas.

Geologic Horizon: Basal beds of Wheelock member, Cook Mountain formation, Claiborne group, middle Eocene. Syntype 1 comes from bed (ad) of the Stone City bluff as described by the writer in a previous paper (Stenzel, H. B., A new formation in the Claiborne group: Univ. Texas Bull. 3501, p. 267–279, 1936). This bed is 4.2 feet thick and is 4.2 to 8.4 feet above the base of the Cook Mountain. Syntypes 2, 3, and 4 come from bed (ab) of the bluff. This bed is 3.7 feet thick and is 0.2 to 3.9 feet above the base of the Cook Mountain.

In keeping with the near-shore and transgressional character of the basal Cook Mountain beds the deltidial plates of the pedicle valves are missing, all types are found as loose single valves, and the types found in bed (ab) are slightly rounded by wave action.

Distribution: Known only from type locality.

Dimensions.—Syntype 1 (brachial valve), length 3.85 mm., width 4.88 mm. (Pl. 34, figs. 1–2); syntype 2 (brachial valve), length 2.57 mm., width 2.95 mm.; syntype 3 (pedicle valve), length 5.12 mm., width 5.09 mm.; syntype 4 (pedicle valve), length 3.75 mm., width 3.72 mm. (Pl. 34, figs. 3–4).

Synonymy:

1940 *Argyrotheca akymatophora* Stenzel, H. B., New Eocene brachiopods from the Gulf and Atlantic Coastal Plain: Univ. Texas Pub. 3945, p. 718–720, pl. 34, figs. 1–4.

Original Description: The type material consists of four loose valves, two brachial and two pedicle valves.

Exterior of brachial valve devoid of plications or ribs, ornamented only with growth lines and the punctae. Hinge line straight. Growth lines and outline of valve almost semicircular. However, the greatest width of the valve is attained in front of and not at hinge line. Syntype 1 has a very faint median radial furrow.

Interior of brachial valve with a prominent nose-like median septum. An inconspicuous low ridge extends diagonally across each corner of the valve. Parallel with the hinge line extend the groove-like dental sockets, each bounded by a ridge. The groove-like dental sockets and ridges and the median septum radiate from a roughly pentagonal area located in the center of the hinge line.

Exterior of pedicle valve devoid of plications or ribs, ornamented only with growth lines and punctae. Growth lines nearly semicircular. Cardinal area triangular; beak prominent but rounded. Delthyrium large triangular.

Interior of pedicle valve with a low median septum. This septum is thin and narrow in the posterior half of the valve. It is low and wide in the middle and tapers out to the front. Teeth of hinge inconspicuous, merely slightly thickened corners.

Brachial valve almost flat, pedicle valve slightly inflated.

Original Remarks: This is the first and only species of *Argyrotheca* known from the Claiborne group of the Gulf Coastal Plain.

Due to its distribution which is limited to the type locality it can hardly be confused with other species. However, the following characteristics distinguish it from its congeners: both valves are devoid of plications and the growth lines are semicircular to oval.

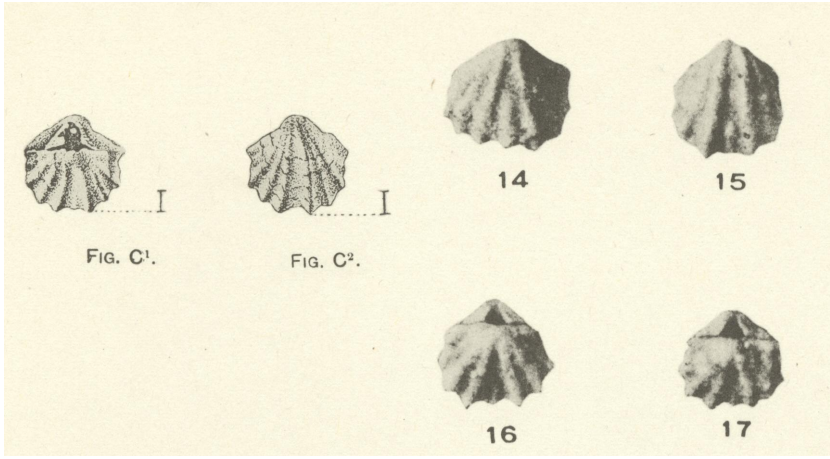
Argyrotheca schucherti Dall, *A. wegemanni* Cole, *A. gardnerae* Cooke (Cooke, C. W., *Argyrotheca gardnerae*, new name: Washington Acad. Sci. Jour., vol. 25, p. 34, 1935, and Contributions to the geology and paleontology of the West Indies: Carnegie Inst. Washington, Pub. 291, p. 152, pl. 16, figs. 5a–5c, 1919), *A. dalli* Aldrich, *A. beecheri* (Clark), *A. plicatilis* (Clark), and *A. hatchetigbeensis* Stenzel are plicate on both valves and differ therein markedly from this species. *Argyrotheca powersi* Gardner has no plications on the brachial valve, but has well developed plications on the pedicle valve. On the other hand, *A. berryi* Olsson (Olsson, A. A., Contributions to the Tertiary paleontology of northern Peru, pt. 2: Upper Eocene Mollusca and Brachiopoda: Bull. Am. Paleontology, vol. 15, no. 57, p. 100–101, pl. 1, figs. 9–11, 1929) from the upper Eocene Saman formation of Peru is consistently devoid of plications on both valves and very similar in general appearance to *A. akymatophora* Stenzel. In addition, *A. berryi* is near to *A. akymatophora* in stratigraphic age. Differences between these two species are slight. The chief difference is in the outline of the valves. The valves of *A. berryi* are consistently wider in proportion to their length than the corresponding valves of *A. akymatophora*. For instance, the pedicle valves of *A. berryi* are much wider than long; the same valves of *A. akymatophora* are about as wide as they are long.

The specific name is derived from the Greek α (not), κυμα (wave, plication), φερος (bearing).

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

BEECHERI (CLARK)

ARGYROTHECA



Figs. C¹, C²—Clark 1895,
Figs. 14–17—Weller 1907.

Type Data: Types presumably in Geological Department, The Johns Hopkins Univ., Baltimore, Maryland.

Type Locality: Marl pits on south bank of Rancocas Creek, about one-half mile below Vincentown, Burlington County, New Jersey.

Geologic Horizon: Vincentown lime sand, Rancocas group, lower Eocene.

Distribution: Known only from type locality.

Synonymy:

1895 *Cistella beecheri* Clark, W. B., Two new brachiopods from the Cretaceous of New Jersey: Johns Hopkins Univ. Circ., vol. 15, no. 121, p. 3, figs. C¹–C².

1907 Weller, S., A report on the Cretaceous paleontology of New Jersey: New Jersey Geol. Survey, Paleont. ser., vol. 4, p. 361–362, pl. 27, figs. 14–17.

Original Description: Shell small, subcircular to subpentagonal in outline, convex, longer than wide, with greatest width along the hinge-line; surface covered with a few prominent plications, in the largest forms generally eight in number, gradually decreasing in size toward the sides; wide, deep sinus generally occupies the median line, although an intercalated plication appears in some of the larger forms.

Ventral valve full; beak moderately high, somewhat attenuate; area linear, triangular, reflexed; foramen large.

Dorsal valve full, about two-thirds length of shell; septum prominent, but most of the brachial structure is destroyed.

The measurements of the specimens obtained show the length to vary from 1 mm. to 3 mm., and the width from .75 mm. to 2.25 mm.

The mature forms are more ventricose, with a somewhat greater width in the cardinal region, more elevated and curved beaks, and stronger plications upon the surface.

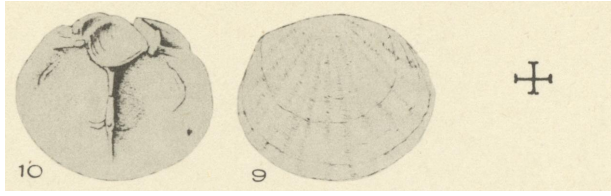
Observations: Weller neglected to give the enlargement of his figures.

The following key gives the characteristics of and differences between the various species of *Argyrotheca* in the older Tertiary of the Coastal Plain of the United States:

A. No plications on either valve — *akymatophora* Stenzel
B. No plications on brachial valve, well developed plications on pedicle valve — *powersi* Gardner
C. Very feeble plications on brachial valve, well developed plications on pedicle valve — *hatchetigbeensis* Stenzel
D. Well developed plications on both valves
  a. Plications uniformly distributed over shell
    1. Brachial valve plications 10–12 in number, brachial valve widest at hinge — *plicatilis* (Clark)
    2. Brachial valve plications about 14 in number, brachial valve widest in middle — *dalli* Aldrich
  b. Plications parted along middle of shell producing a deep sinus which may be occupied by a short intercalated plication
    1. Plications up to 10 or more; not prominent, if present at all — *saltmountainensis* Toulmin
    2. Plications up to 8 and prominent — *beecheri* (Clark)

DALLI ALDRICH

ARGYROTHECA



Figs. 9, 10—Aldrich 1911.

Type Data: Monotype presumably in Geological Department, The Johns Hopkins Univ., Baltimore, Maryland.

Type Locality: Bluff at Hatchetigbee landing on right bank of Tombigbee River, by road 4.25 miles east-northeast of Frankville, Washington County, Alabama.

Geologic Horizon: Hatchetigbee formation, Wilcox group, lower Eocene.

Distribution: Known only from type locality.

Synonymy:

1911 *Argyrotheca dalli* Aldrich, T. H., New Eocene fossils from the Southern Gulf States: Bull. Am. Paleontology, vol. 5, p. 13, pl. 5, figs. 9, 10.

Original Description: Shell quite small; dorsal valve oval, exterior with about fourteen folds radiating from the beak. Surface covered with fine lines, and also finely perforated; within also finely perforated but the perforations do not seem to extend through the shell. Median septum strong, elevated, reaching nearly to the base.

Height 4; width 4.5 mm.

Hatchetigbee Bluff, Tombigbee River, Ala.

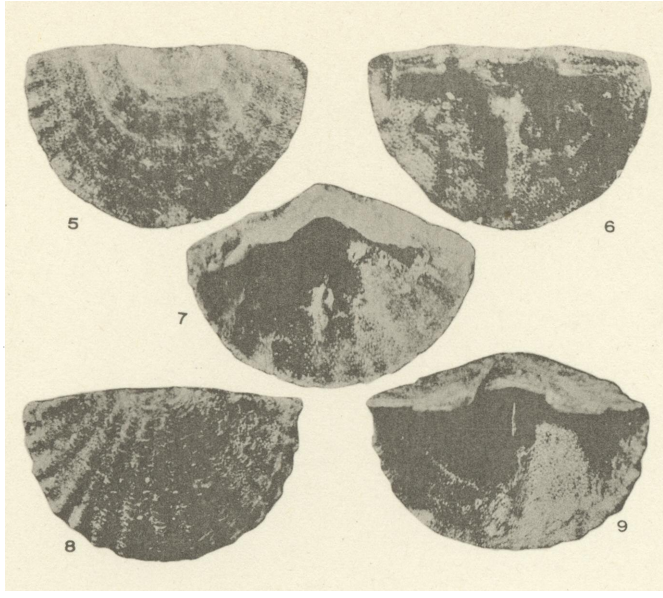
Dorsal valve only known. This genus is new to our Eocene.

Observations: The following key gives the characteristics of and differences between the various species of *Argyrotheca* in the older Tertiary of the Coastal Plain of the United States:

A. No plications on either valve — *akymatophora* Stenzel
B. No plications on brachial valve, well developed plications on pedicle valve — *powersi* Gardner
C. Very feeble plications on brachial valve, well developed plications on pedicle valve — *hatchetigbeensis* Stenzel
D. Well developed plications on both valves
   a. Plications uniformly distributed over shell
      1. Brachial valve plications 10–12 in number, brachial valve widest at hinge — *plicatilis* (Clark)
      2. Brachial valve plications about 14 in number, brachial valve widest in middle — *dalli* Aldrich
   b. Plications parted along middle of shell producing a deep sinus which may be occupied by a short intercalated plication
      1. Plications up to 10 or more; not prominent, if present at all — *saltmountainensis* Toulmin
      2. Plications up to 8 and prominent — *beecheri* (Clark)

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

HATCHETIGBEENSIS STENZEL



Figs. 5, 6—outside and inside of brachial valve, syntype 1,
Fig. 7—inside of pedicle valve, syntype 2,
Figs. 8, 9—outside and inside of pedicle valve, syntype 3; all X 7.

Type Data: The 10 syntypes are in the writer's collection at Austin, Texas.

Type Locality: Bluff at Hatchetigbee landing on the right bank of Tombigbee River, by road 4.25 miles east-northeast of Frankville, Washington County, Alabama. (Best available map is map No. 13 in Semmes, D. R., Oil and gas in Alabama: Geol. Surv. Alabama, Special Rept. 15, p. 364, 1929.)

Geologic Horizon: Hatchetigbee formation, Wilcox group, lower Eocene.

Distribution: Known only from type locality.

ARGYROTHECA

Synonymy:

1940 *Argyrotheca hatchetigbeensis* Stenzel, H. B., New Eocene brachiopods from the Gulf and Atlantic Coastal Plain: Univ. Texas Pub. 3945, p. 720–722, pl. 34, figs. 5–9.

Original Description: The type material consists of 8 loose pedicle valves and 2 loose brachial valves.

Exterior of the brachial valve ornamented with approximately 13 low and very indistinct radial ribs. Hinge line straight. Growth lines and outline of valve nearly semicircular. The greatest width of the valve is attained at the hinge line.

Interior of brachial valve with a prominent nose-like median septum. There is no ridge extending across the corners of the valve. Parallel with the hinge line extends a dental groove and a ridge on each side. The grooves and ridges and the median septum radiate from an area located at the center of the hinge line. This area is wide from left to right but narrow in antero-posterior direction, the proportion in these two directions being about 3 to 1.

Exterior of pedicle valve with approximately 13 to 17 well defined radial ribs which begin a short distance from the point of the beak. As the shell grows the number of ribs increases by intercalation of new ribs. In old specimens the ribs become obsolete so that the valve is smooth along the margin. Cardinal area triangular and steep. Beak prominent but rounded. Delthyrium large, but not extending to the beak.

Interior of pedicle valve with a low median septum. This septum is very thin in the posterior half of the shell and broad and low in the anterior half and disappears toward the front margin. Teeth of hinge inconspicuous, merely slightly thickened.

Brachial valve flat, pedicle valve slightly inflated and of the shape of a low half-cone.

Dimensions.—The three figured types have the following dimensions in millimeters:

Valve	Syntype	Length	Width	
Brachial	1	2.64	4.13	(See Pl. 34, figs. 5–6.)
Pedicle	2	3.34	4.12	(See Pl. 34, fig. 7.)
Pedicle	3	3.14	4.2	(See Pl. 34, figs. 8–9.)

Original Remarks: This is the second species described from the same locality, that is, Hatchetigbee bluff. The other species is *Argyrotheca dalli* Aldrich. These two species are the only ones known from the Wilcox group of the Gulf Coastal Plain. *Argyrotheca* n.sp. Toulmin is a third but as yet undescribed species from that group.

The differences between these two species concern only the brachial valve because the pedicle valve of *A. dalli* Aldrich is as yet unknown. The brachial valve of *A. dalli* has well marked radial plications; the same valve of *A. hatchetigbeensis* has very indistinct radial plications. The outline of the valve in *A. dalli* is oval because the greatest width is at the middle of the valve and not at the hinge line; the outline of the valve in *A. hatchetigbeensis* is semicircular and the hinge line is the widest part of the valve. In the interior of the valve *A. dalli* has a large round area occupying the center of the hinge line; the same area in *A. hatchetigbeensis* is wide from left to right but narrow from anterior to posterior. The dental grooves and ridges, which are to both sides of this area and parallel with the hinge, are short in *A. dalli* and long in *A. hatchetigbeensis*.

Argyrotheca hatchetigbeensis and *A. powersi* Gardner are somewhat similar in one respect, namely, the discrepancy in ornamentation of brachial and pedicle valve. In *A. hatchetigbeensis* the brachial valve has very feeble plications, but the pedicle valve has well developed plications. In *A. powersi* the brachial valve has no plications, but the pedicle valve has well developed plications.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

PLICATILIS (CLARK)

ARGYROTHECA

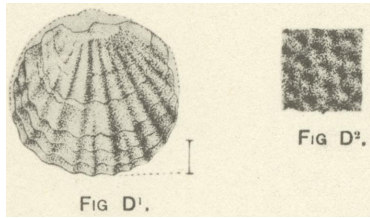


Fig. D—Clark 1895.

Type Data: Types presumably in Geological Department, The Johns Hopkins Univ., Baltimore, Maryland.

Type Locality: Marl pits on south bank of Rancocas Creek, about one-half mile below Vincentown, Burlington County, New Jersey.

Geologic Horizon: Vincentown lime sand, Rancocas group, lower Eocene.

Distribution: Known only from type locality.

Synonymy:

1895 *Cistella plicatilis* Clark, W. B., Two new brachiopods from the Cretaceous of New Jersey: Johns Hopkins Univ. Circ., vol. 15, no. 121, p. 3, fig. D.

1907 Weller, S., A report on the Cretaceous paleontology of New Jersey: New Jersey Geol. Survey, Paleont. ser., vol. 4, p. 362–363.

Original Description: Shell moderate sized, orbicular, slightly convex, longer than wide; surface with a considerable number of plications, ten or twelve on dorsal valve, together with a few short intercalated ones near the margin.

Dorsal valve slightly inflated; septum prominently developed.

The dimensions of the single specimen of the dorsal valve obtained are about 4.5 mm. both in length and width.

The species is quite distinct from *Cistella beecheri.*

Observations: The dotted restoration line on Clark's figure is slightly erroneous. The growth lines indicate that the valve was widest at the hinge line.

The following key gives the characteristics of and differences between the various species of *Argyrotheca* in the Tertiary of the Coastal Plain of the United States:

A. No plications on either valve — *akymatophora* Stenzel
B. No plications on brachial valve, well developed plications on pedicle valve — *powersi* Gardner
C. Very feeble plications on brachial valve, well developed plications on pedicle valve — *hatchetigbeensis* Stenzel
D. Well developed plications on both valves
  a. Plications uniformly distributed over the shell
    1. Brachial valve plications 10–12 in number, brachial valve widest at hinge — *plicatilis* (Clark)
    2. Brachial valve plications about 14 in number, brachial valve widest in the middle — *dalli* Aldrich
  b. Plications parted along middle of shell producing a deep sinus which may be occupied by a short intercalated plication
    1. Plications up to 10 or more; not prominent, if present at all — *saltmountainensis* Toulmin
    2. Plications up to 8 and prominent — *beecheri* (Clark)

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

POWERSI GARDNER

ARGYROTHECA

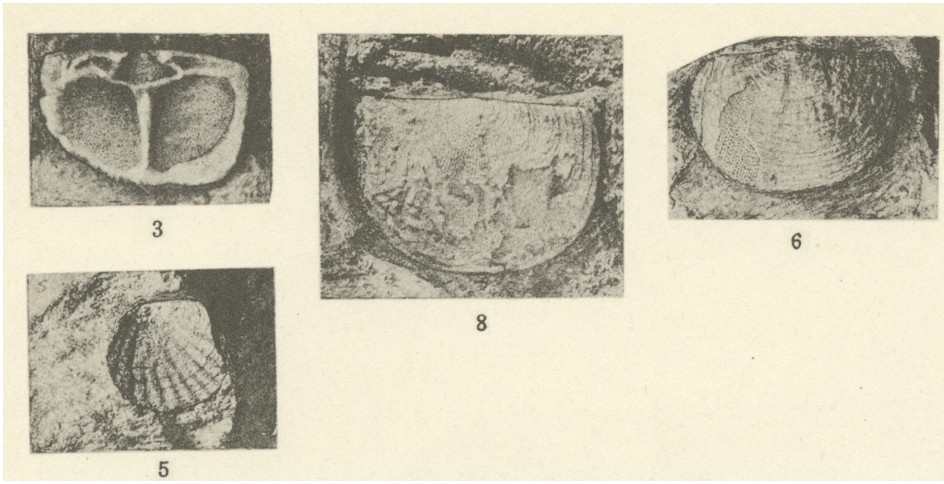


Fig. 3—interior of dorsal valve, X 6,
Fig. 5—mold of part of ventral valve, X 4,
Fig. 6—exterior of dorsal valve (type), length 4.0 mm., width 6.0 mm.,
Fig. 8—exterior of dorsal valve, outer surface decorticated, X 6; Gardner 1925 and 1933.

Type Data: Types in U. S. Nat. Mus., Washington, D.C. Holotype U. S. Nat. Mus. No. 353083 (fig. 6).

Type Locality: One-fourth mile northwest of Gin Lake on Butler salt dome, 2½ miles east of Butler, Freestone County, Texas.

Geologic Horizon: Conglomeratic ferruginous limestone, probably from the Wills Point formation, Midway group, Paleocene.

Distribution: Known only from type locality.

Synonymy:

1925 *Argyrotheca powersi* Gardner, J., A new Midway brachiopod, Butler salt dome, Texas: Am. Jour. Sci., 5th ser., vol. 10, p. 134–138, figs. 1–8.

1933 Gardner, J., The Midway group of Texas: Univ. Tex. Bull. 3301, p. 113–115, pl. 5, figs. 1–8.

Original Description (slightly edited): Shell large for the genus, transversely elongate, rather thick and heavy, strongly punctate, the tubuli relatively large and widely spaced. Dorsal valve flattened, warped inward at the anterior and lateral margins. Ventral valve moderately convex; outline varying widely in relative proportions, semi-elliptical to subrectangular; the angle between the cardinal line and the lateral margins approaching a right angle; the anterior margin nearly horizontal medially, curving broadly and smoothly upward at the distal extremities. External surface rarely preserved, feebly plicate, concentrically rugose toward the outer margin. Cardinal area rather low, broadly trigonal, restricted almost entirely to the ventral valve. Deltidial opening large, rudely trigonal, much eroded. Deltidial plates small, widely separated. Medial septum in dorsal valve very high, reaching its apex a little behind the median horizontal; alae developed in the adults at or near the apex, extending backward to the hinge plates. Dental sockets moderately deep. Septum in ventral valve low and apparently uniform in elevation from the beak to the anterior margin. Dental characters of ventral valve not observed.

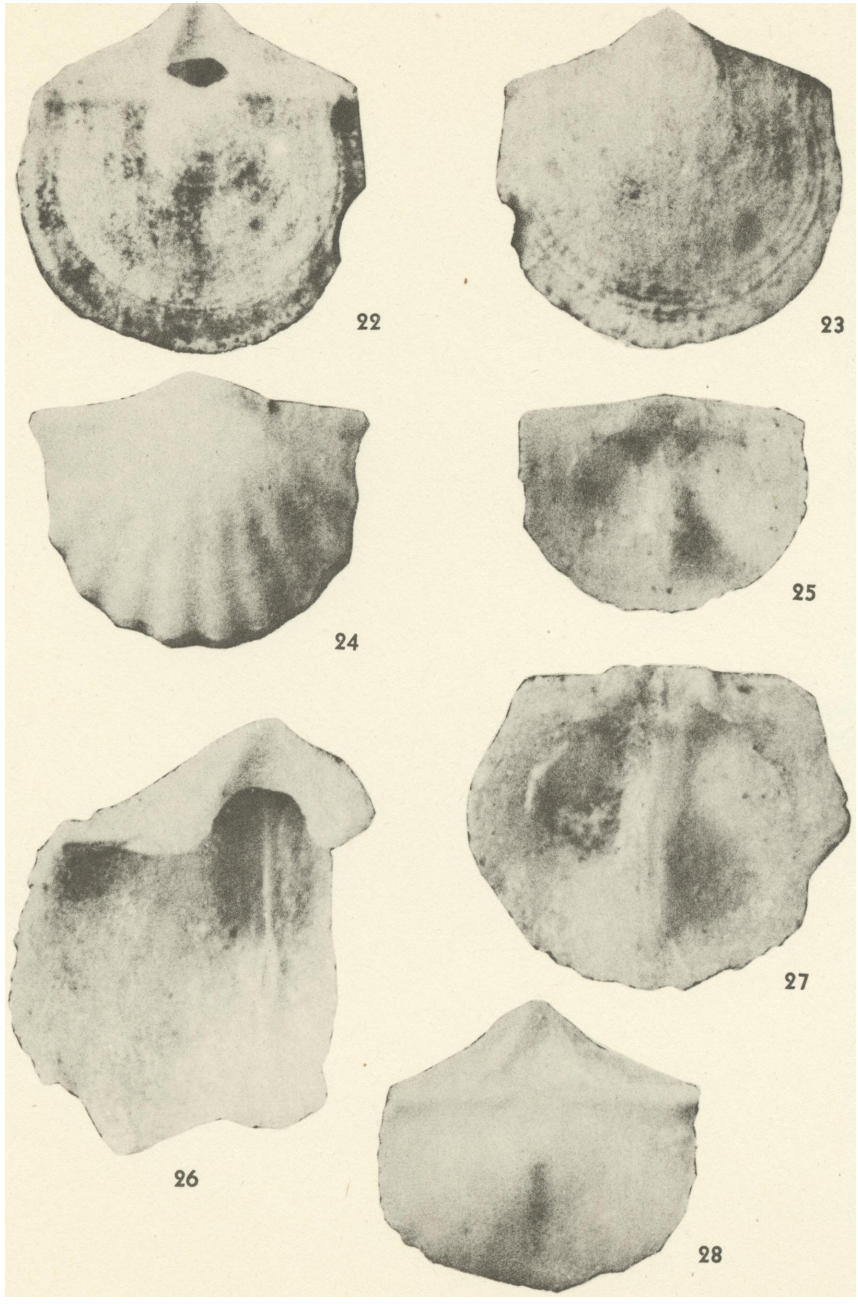
Dimensions.—Dorsal valve (type): altitude, 4.0 mm.; latitude, 6.0 mm. Ventral valve of another individual: altitude, 4.0 mm.; latitude, 4.0 mm. Fragments of other shells indicate dimensions half as large again as those attained by the type.

Observations: The following key gives the characteristics of and differences between the various species of *Argyrotheca* in the older Tertiary of the Coastal Plain of the United States:

A. No plications on either valve — *akymatophora* Stenzel
B. No plications on brachial valve, well developed plications on pedicle valve — *powersi* Gardner
C. Very feeble plications on brachial valve, well developed plications on pedicle valve — *hatchetigbeensis* Stenzel
D. Well developed plications on both valves
   a. Plications uniformly distributed over shell
      1. Brachial valve plications 10–12 in number, brachial valve widest at hinge — *plicatilis* (Clark)
      2. Brachial valve plications about 14 in number, brachial valve widest in middle — *dalli* Aldrich
   b. Plications parted along middle of shell producing a deep sinus which may be occupied by a short intercalated plication
      1. Plications up to 10 or more; not prominent, if present at all — *saltmountainensis* Toulmin
      2. Plications up to 8 and prominent — *beecheri* (Clark)

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

SALTMOUNTAINENSIS TOULMIN



ARGYROTHECA

Synonymy:

1940 *Argyrotheca saltmountainensis* Toulmin, L. D., Eocene brachiopods from the Salt Mountain limestone of Alabama: Jour. Paleontology, vol. 14, p. 231–232, pl. 28, figs. 22–28.

Original Description: Shell minute, outline varying widely in relative proportions, generally semicircular, less commonly transversely elongate. Cardinal margin megathyrid, hinge straight. Angle between the cardinal line and the lateral margins approaching a right angle. Lateral profile nearly planoconvex. Anterior commissure rectimarginate, lateral commissures curving upward at the posterior extremities. Shell surface smooth to feebly multiplicate opposite; strongly punctate. Plicae absent or feeble, varying in number up to 10 or more. External surface of some specimens concentrically rugose near the margin. Median line of both valves in a few specimens occupied by a shallow sulcus. Beak short, subtruncate. Cardinal area varying greatly in height in different individuals. Foramen large, trigonal. Deltidial plates small, disjunct. Median septum in the ventral valve thin and keel-like, extending forward nearly to the middle of the valve. Small pit at the forward end of the septum near the middle of the ventral valve. In some specimens the septum continues as a low broadly rounded ridge nearly to the anterior margin. Median septum in dorsal valve extending nearly to the anterior margin of the valve, high, triangular in profile. Apex of septum near the middle of the valve. Apex fits into small pit near the middle of the ventral valve.

Dimensions of holotype: Length, 2.22 mm; width, 2.28 mm.

Original Remarks (abbreviated): This species is common throughout the Salt Mountain limestone. There is considerable individual variation in the length of the hinge line, elongation of the shell, length of the beak, height of the cardinal area, and prominence of the plications, but there is intergradation among individuals in all of these characters, and they all probably belong to one species.

Specimens obtained from the somewhat argillaceous limestone on Richmond Branch were characterized by having a lower cardinal area and a posteriorly projecting beak. The specimen selected as the type is characteristic of those from this locality. Shells of specimens from other facies of the limestone are thicker dorsoventrally, the cardinal area is higher, the beak is directed ventrally rather than posteriorly, and the outline is commonly transversely elongate. These differences in shape may be due to the differences in shape of the objects to which the shells were attached. Specimens attached by a short pedicle to wide flat surfaces may develop a broader hinge line, a higher cardinal area, and a more truncated beak than those specimens attached in such a way that the beak and cardinal area can grow unhindered.

Figs. 22, 23—dorsal and ventral views of holotype,
Fig. 24—ventral view of strongly ribbed specimen, paratype No. 50754,
Fig. 25—interior of dorsal valve, paratype No. 50755,
Fig. 26—interior of ventral valve, paratype No. 50756,
Fig. 27—interior of dorsal valve, paratype 6,
Fig. 28—dorsal view of ribless specimen, paratype 7; all X 21.

Type Data: Holotype, No. 50753, and paratypes, Nos. 50754–50756, in Geology Dept., Princeton University, Princeton, New Jersey. Paratypes 6–8 in Alabama Mus. Nat. History, University, Alabama.

Type Locality: Richmond branch, 400 feet southeast of the spring, ½ mile north of Salt Mountain, about 6 miles south of Jackson, Clarke County, Alabama, northwest ¼ of northwest ¼ of sec. 34, T. 6 N., R. 2 E.

Geologic Horizon: Salt Mountain limestone, Wilcox group, lower Eocene.

Distribution: Known only from type locality.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

CRETACEA WELLER

PLATIDIA

Figs. 18, 19—Weller 1907.

Type Data: Unknown.

Type Locality: North bank of Rancocas Creek, one-quarter mile northwest of Vincentown, Burlington County, New Jersey.

Geologic Horizon: Vincentown lime sand, Rancocas group, lower Eocene.

Distribution: Known only from type locality.

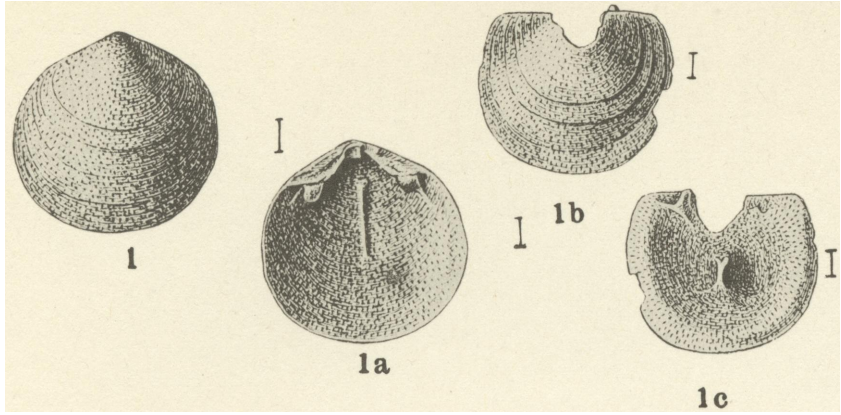
Synonymy:

1907 *Platidia cretacea* Weller, S., A report on the Cretaceous paleontology of New Jersey: New Jersey Geol. Survey, Paleont. ser., vol. 4, p. 168, 363, pl. 27, figs. 18, 19.

Original Description: Shell minute, the dimensions of the largest specimen observed being: Length, 1.76 mm.; and width, 1.66 mm.; subovate in outline with the valves subequally depressed convex, so that the form of the entire shell is lenticular. Surface of the valves smooth, the shell structure minutely punctate. Pedicle valve with a prominent cardinal area which is bisected by a large open foramen; brachial valve with a large pedicle incision about equal in size to that of the opposite valve. Internal features of the shell not observed.

Observations: *Platidia cretacea* is less than half the size of *Platidia marylandica* Clark & Martin from the Aquia formation of Maryland. These two species occur in formations which are of approximately the same age.

MARYLANDICA CLARK & MARTIN



Figs. 1–1c—Clark & Martin 1901.

Type Data: Monotype presumably in Geology Department, Johns Hopkins Univ., Baltimore, Maryland.

Type Locality: East of bridge at Upper Marlboro, Prince Georges County, Maryland.

Geologic Horizon: Paspotansa glauconite member of Aquia formation, lower Eocene. The fossil occurs in a five-feet thick glauconitic bryozoan sand 34 feet below the top of the Aquia formation.

Distribution: Known only from type locality.

Synonymy:

1901 *Platidia marylandica* Clark, W. B., & Martin, G. C., Mulluscoidea Brachiopoda, *in* Systematic Paleontology, Eocene: Maryland Geol. Survey, Eocene, p. 72, 203, pl. 58, figs. 1–2c.

Original Description: Shell small, subcircular, somewhat depressed, with well-marked lines of growth; ventral valve with hinge-area prominent, high, bisected by a large open foramen and with a well-defined, linear septum in the interior; dorsal valve with large pedicle incision, and with a short, high, slightly bifurcated medium septum in the interior; teeth and sockets prominent; shell structure minutely punctate.

This beautiful little brachiopod is not uncommon at Upper Marlboro where it is found associated with bryozoans and foraminifera. There is no other American fossil species of this genus.

Length, 4 mm.; width, 4 mm.

Observations: *Platidia marylandica* is more than twice as large as *Platidia cretacea* Weller from the Vincentown formation of New Jersey. These two species occur in formations which are of approximately the same age.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.

SP. TOULMIN

PLATIDIA?

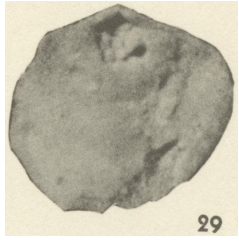


Fig. 29—dorsal view of shell, X 20.

Type Data: Specimen in Geology Department, Princeton University, Princeton, New Jersey.

Type Locality: Top of hill, 3000 feet south of Salt Mountain, Clarke County, Alabama, in southwest corner of southwest ¼ of northwest ¼ of sec. 3, T. 5 N., R. 2 E.

Geologic Horizon: Salt Mountain limestone, Wilcox group, lower Eocene.

Distribution: Only one specimen known.

Synonymy:

1940 *Platidia?* sp. Toulmin, L. D., Eocene brachiopods from the Salt Mountain limestone of Alabama: Jour. Paleontology, vol. 14, p. 233, pl. 28, fig. 29.

Original Description: Shell minute, subcircular in outline, hinge line straight. Ventral valve convex. Dorsal valve flat to irregular. Test smooth. Foramen amphithyrid. Foraminal notch in dorsal valve large, semicircular.

Dimensions of illustrated specimen: Width, 1.56 mm.

Prepared by H. B. Stenzel, Bureau of Economic Geology, Austin, Texas.